COAL AGE

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For The New Year

By Berton Braley

Written expressly for Coal Age

Now we have come to the first of the year,
Time to start in on a record that's clear,
Time to begin on a page that is clean,
How shall we fill it in nineteen fourteen?
What shall we make it—a year full of self,
Greed and Unkindness, and struggle for pelf?
Or plan out our lives on a better design,
Up in the office or down in the mine?

How shall we play in the game that is life,
Make it a battle, a war to the knife?
Or fill it with tenderness, honor and truth,
With succor to age and with welcome to youth?
Let us be true to the best that we know,
Owner or Miner—on top or below—
Let us be brothers, whatever our line,
Up in the office or down in the mine.

Now we have come to the first of the year,
Let us start in for a season of cheer,
Let us be true to the faith and the job,
Workmen who serve—and not bandits who rob!
Whether we handle a pick or a pen
Let us be servants and comrades of men,
Making life nearer the Master's design,
Up in the office or down in the mine!

Start the New Year with New Determination

Every normal man is ambitious to a certain degree. In some people this feeling is narrowed down to a definite aim; there is not a diversity of desires—only a single aspiration, and all effort of the individual is directed with the idea of attaining this one goal. Such men are specialists in the true sense of the word.

There are others, however, who are ambitious in a general way. Success to them is a broad term and covers a mighty field of action. They want to excel, but are not particular as to the line of work in which they engage, so long as the material results are satisfactory. They are honest men, and often efficient, but they lack concentration—singleness of purpose—which is a most essential quality in this age of specialization.

Start the New Year with a settled aim and a definite ambition. You are in the coal-mining business, and it's one of the nation's greatest basic industries. There are approximately a million men engaged in the work, and they need thousands of leaders. This insures those who are deserving, an opportunity to advance, if they are made of the right stuff.

And the lower down you are in the scale of employment, the more jobs that beckon you on. There are twice as many foremen as superintendents, and three times as many of the latter as there are managers. But none of these positions is to be obtained, or afterward held, unless the individual is willing to pay the price in earnest labor seriously and intelligently rendered.

Right now is the time of the year when you should balance your accounts. Have you anything to show for the work of the last twelve months? If you haven't, then you have done worse than stand still, for you are a year older, and just that much nearer the time when you can't be so sure of the punch left in your fighting arm.

Have you devoted a few hours each week to study and to keeping informed on the progress of your industry? Or, have you spent all your evenings trying to banish care and drive worry from your mind? Too many men think that "worry and care" can be expelled by a song and a bottle; but they seem to forget that such expulsion is only temporary, for the old lady will always be back with them "the morning after." You may drive the old hag away time and again while money and health last, but finally she will come back and stay to the finish.

The only way you can forever banish care is to meet her squarely, study her methods and discover her motives. Then you may get rid of her permanently by first understanding her. Freedom from worry and consequent "peace of mind" must be earned. Relief through alcohol and dissipation will prove as transitory as the opium fiend's dream of wealth and power.

If you haven't strengthened your position during the year that is dying, resolve that the coming twelve months will be devoted to preparing for the future, and be occupied in making your position in life safer. A little sensible worry now will mean peace later, for nothing is more terrible than to plod along under the crack of the whip when old age has come on. If you don't believe this is true, look about at the shuffling feet and nerveless hands of those who were careless in youth.

Don't you think it is time you stopped looking for luck to bless you, or Providence to hand you something, and come to the conclusion that hard work alone will solve your problems and net you a real return? Isn't it time you determined to live within your income and save something, no matter how little it may be? Now is the time to labor, to sacrifice and endure hardship, for when the years have piled upon you, it will be found that old age itself is sufficient punishment for one person to bear.

It's all very fine to be known as a good fellow, but it's still better to be spoken of as a respected citizen of much ability and serious intent. You have made many resolutions before, no doubt, and some of them you have broken; however, as the New Year commences, determine to do better and begin by first discovering just where you are deficient. The chances are that you yourself have been your own worst enemy, and that the greatest obstacles in your path have been of your own making.

Remember that, although everyone cannot become famous, anyone with health can avoid being an utter failure. Some of those now working with you, and having no better chance than you have, will be talked of as a success in years to come. There is no downhill in the road you must travel, it is one continuous climb; all dips in the grade lead backward. It's because so many people forget this fact that the majority fail. *Start the New Year with New Resolutions and New Courage.*

Safety of Portable Electric Mine Lamps

By H. H. Clark*

SYNOPSIS—Describes the tests applied by the Bureau of Mines to the Ceag, Hirsch and Wico lamps to determine whether they would be extinguished on the breaking of the lamp bulbs, whether the filaments were liable to cease to glow when the lamps were exposed to violence which did not destroy the bulbs and whether a reasonable degree of rough usage would impair the batteries.

Portable electric mine lamps are a comparatively new development in this country, although they have been used in European mines for some time. William Maurice, in a lecture before the University College of Nottingham, England, stated that as early as 1887, 600 portable electric lamps were installed in a colliery in South Wales. He adds that the use of these lamps was eventually discontinued, but that 10 years later portable electric lamps were used regularly in England as a substitute for flame lamps, over 1000 lamps being in daily use by the latter part of 1899.

E. N. Zern stated in the *Coal and Coke Operator* of Mar. 14, 1912, that in 1904 several thousand portable electric lamps were in use in the mines of England and Belgium. Portable electric lamps are now used extensively in European coal mines, and in a competition held recently in England, 195 different lamps of this type were entered. For at least five years and probably for a longer time, portable electric lamps have been used here and there in the mines of this country in the attempt to develop a satisfactory substitute for the safety lamp.

Electric Lamps Safer than Flame Lamps

The Bureau of Mines advocates the adoption of the electric lamp because fire and explosion hazards will be decreased thereby. It is therefore manifest that the electric lamp itself must not be a source of danger. The bureau has proved by actual test that the glowing filaments of portable electric lamps are capable of igniting mine gas, but that sparks from such equipments of not more than six volts cannot ignite the gas unless the equipments are unusually large.

When, therefore, the bureau decided to make tests to establish the permissibility of lamps for use in gaseous mines, sparks were ignored as not being an element of danger while safeguards were required for the glowing filaments. Schedule 5, which was issued to announce the bureau's tests, contained the following paragraph:

> Permissible portable electric lamps shall be so designed and constructed that under no circumstances can the bulb of a completely assembled lamp be broken while the lamp filament is glowing† at a temperature sufficient to ignite explosive mixtures of mine gas and air.

Bureau's Approval of Lamps Limited to Safety Qualities

The schedule gives in detail the requirements of design, the character of the tests to which the lamp is to be submitted, and the conditions under which the tests will be made. Beyond requiring that the mechanical construction of the lamps should be rugged, no attempt was made to insure the capacity, efficiency or practicability of the lamps tested, although those that were manifestly incomplete or inadequate for mine service were not accepted for test. Therefore, it is clear that the bureau's approval of a lamp as permissible means that it vouches for the safety of the lamp but not for its capacity, time of burning, or expense and labor of maintenance.

In response to the invitation contained in Schedule 5, six lamps were submitted to the bureau for test. Three of these were rejected on account of their inadequate construction or lack of safety devices. The other three lamps were tested and after changes were made in some of them, they were approved as permissible for use in gaseous mines.

When the lamps were first received they were carefully examined in order to determine what kind of a blow would be most likely to cause the safety devices to fail in the performance of their function. The most dangerous conditions being assumed, tests were made under these conditions to determine whether or not the safety devices would really prevent the filament from igniting gas when the bulb was broken. Other tests were made to determine whether or not the safety devices were so constructed that they would give trouble by extinguishing the lamp when there was no need for such action and finally experiments were made to test the mechanical strength of the battery and its casing.

The Ceag Lamp

The Ceag lamp is constructed for hand service, and is the first lamp which was approved by the Bureau as permissible for use in gaseous mines. The lamp bulb is suspended between two spiral springs in such manner that whenever either the bulb or the glass dome which surrounds it is broken, the electric current of the lamp will cease to flow.

A preliminary examination seemed to indicate that there were only three possible ways in which the lamp could ignite gas.

1. It was conceivable that both the outer glass and the bulb might be so broken that the electric circuit would not be interrupted and the filament would therefore continue to glow.

2. The blow breaking the dome and the bulb might be of such a nature as to pin the bulb in place so that it could not release from the circuit even though the top spring were thrown out of position. The possibility that the safety devices might fail as a result of either of the above occurrences was investigated by 33 tests.

3. Even though the automatic devices operated perfectly when the lamp was broken, it was conceivable that they would not operate fast enough to interrupt the circuit before the gas became ignited. The possibility of failure under such circumstances was investigated by 13 tests.

The Filament Is Frequently Intact but Light Is Extinguished

These were made by placing the lamp inside a sheet-

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*Engineer-in-charge of electrical investigations, Bureau of Mines, Pittsburgh, Penn.

Note—First part of paper read, Dec. 5, 1913, at the winter meeting of the Coal Mining Institute of America.

†We submit that "while the lamp filament is glowing" should read "in such manner as to permit the filament to glow."—Ed.

iron box 18x18x24 in., filled with the most explosive mixture of Pittsburgh natural gas and air, and provided with observation windows through which the phenomena occurring within the box could be plainly seen. The lamps were lighted and smashed by means of a tool shaped like a pick point, which was driven against the glass dome of the lamp with sufficient force to wreck both the dome and the bulb.

In the tests that were made to ascertain how quickly the safety devices acted, the bulb was not surrounded by the glass dome, but was held in place by the top spring, which was held in its usual position by a wooden block provided specially for the purpose. Despite the fact that the blows administered to the lamp were sufficient to shatter both the outer dome and the lamp bulb, the filament was not injured in nearly 40 per cent. of the tests made, and was prevented from igniting the gas only by the operation of the safety devices, which did not fail to perform their proper functions in any of the tests.

One of these Ceag lamps was dropped 6 ft., 15 times upon a concrete floor. Despite the severity of this test the lamp was extinguished only three times and in each case by the safety device. The lamp was dropped 5 times before the battery was injured in any way, and 12 times before a permanent leak was made in the battery jar. After the lamp had been dropped 15 times, it continued to burn for 16 hr. before going out entirely.

The Hirsch Lamp Is Protected by Short-Circuiting and Circuit-Breaking Devices

The Hirsch lamp is designed for cap service, and was the second type approved by the bureau as permissible for use in gaseous mines. The safety devices with which this lamp is equipped are mounted in the headpiece and consist of an open-circuiting device which protects the lamp against blows from the front, and a short-circuiting provision, which defends the lamp against blows from the side.

The open-circuiting device is operated by the breaking of a slip of window glass which is mounted directly across the inner surface of the bulls-eye with which the lamp is provided. The breakage of this slip of glass releases a spring which opens the circuit. The short-circuiting of the lamp is accomplished as follows: The headpiece is made up of three concentric shells separated but a short distance. The outer and the inner shell are connected to the positive pole of the battery and the intermediate shell to the negative pole. These shells, of course, completely surround the lamp bulb, and the theory of the safety device is that the bulb cannot be broken without so jamming these shells together that they will short-circuit the battery and thus extinguish the filament before it can ignite gas.

Whenever the Bulb Breaks, the Current Fails

Forty-five tests were made upon this headpiece by striking it with the following tools: A hammer, a wooden mallet, a tool shaped like a miner's pick, a piece of iron pipe, and a wooden club. Some of these tests were made while the headpiece was rigidly supported in various ways and others were made while the headpiece was swinging from the end of its cord.

The blows were struck with sufficient force to crush the headpieces, to shatter the glass in almost every case, and to punch holes completely through the shells, but every time that the lamp bulb was broken the safety devices extinguished the filament. In some of the tests the lamp was protected by its circuit-breaker and in others by the short-circuiting device.

In order to find out whether or not the safety devices would extinguish the lamp when it was not necessary they should do so, the headpiece and its cord were dropped 6 ft., 10 times upon a concrete floor. The safety devices acted in only one test and the action was considered to be necessary as the blow that tripped the circuit-breaker also shattered the outer glass of the headpiece. These tests therefore seemed to prove that the safety devices were so designed that they would only extinguish the lamp when necessary. This lamp was designed to be interchangeable for cap and hand service, but its construction was considered to be insufficiently strong for the latter purpose and so it was approved for use on the cap only. The nature of cap service being less severe upon the battery than hand service, the battery was tested by dropping it on a wooden floor a distance of 3 ft. The battery jar was cracked on the second fall, but the lamp still gave its full amount of light after the battery had been dropped 10 times.

The Wico Lamp

This lamp is designed for cap service, and was the third lamp approved by the bureau as permissible for use in gaseous mines. The bulb is so mounted that it is held in its socket by a wire stirrup against the pressure of springs that act to eject the bulb should the stirrup be removed or the bulb broken.

The tests made on this lamp were similar to those made on the Ceag lamp because the principle of the protective devices was the same. Ten tests were made by mounting the headpiece in the gas-testing gallery and smashing the bulb with a pick-pointed testing tool. In these tests the outer glass was removed and the blow directed against the naked bulb in order to determine whether or not the ejecting spring acted with sufficient speed to break the circuit before the gas could become ignited. The device acted perfectly in the 10 tests made.

Ten similar tests were then made with the outer glass in position, and as many more were tried with the blow directed against the socket tube. Finally 10 tests were made outside the gas-testing gallery by striking the headpiece with a mallet, a club and a piece of iron pipe. These latter tests were made largely to determine the mechanical strength of the various parts of the headpiece. In none of the tests did the safety devices fail to exercise their safeguarding function.

Proof against Unnecessary Extinction

Ten tests were made by dropping the headpiece and its cord upon a concrete floor from a point 6 ft. above it. The safety device did not act in any of these tests and consequently it was proven that a casual jar would not extinguish the light. The lamp being designed for cap service only, the dropping tests on the battery were made by dropping it 3 ft. upon a wooden floor. Ten tests were made altogether. The battery jar did not develop a crack until it had been dropped 8 times. After the completion of the dropping tests, the battery operated the lamp for 16 hr. at practically full brilliancy.

The coal supply of Oklahoma is estimated to be 10,000,000,000 tons. The state contains more than 6,000,000 acres of coal-bearing land. Some of the land is estimated to be capable of yielding 7000 tons per acre.

A Premier Operation in Ohio

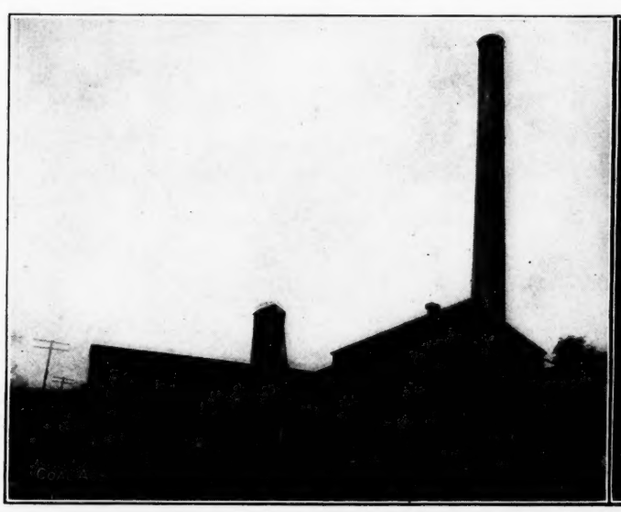
By Sim G. Reynolds*

SYNOPSIS—A description of a new operation which is termed "premier" instead of "model' merely because mines rejoicing in the latter appellation are notoriously dangerous.

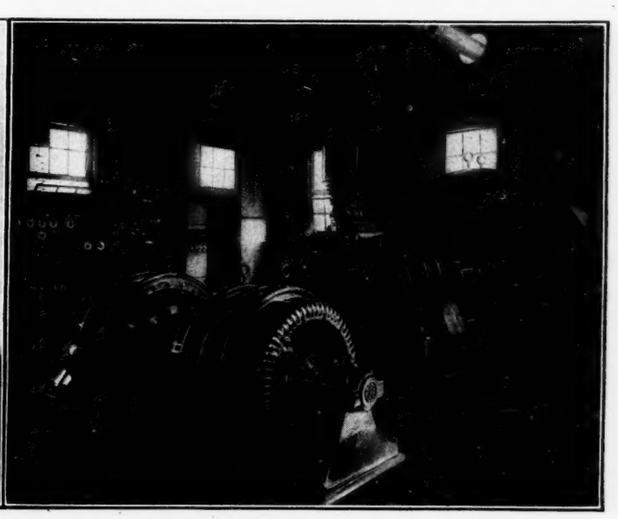
One and one-half miles from St. Clairsville, and about 12 miles West of the Ohio River in Belmont County, Ohio, is located colliery No. 1 of the Provident Coal Co. If the management would allow it, this mine might be designated as being a "model." There seems, however, to be something sinister in the way in which Fate has dealt with our so called model mines in recent years. This serves to give the management of a mine which is really deserving of such a cognomen a species of spinal shivers every time they hear it mentioned.

Superintendents and managers of well planned mines, fully equipped with every modern appliance for economy and safety, are not superstitious, but we all know what has happened to most of the operations which have been proudly designated as "models" in the last decade.

So in order to break the "hoodoo," if any exists, we are compelled to substitute a term synonymous with all that is good and modern in mine methods and equipment as relates to its installation at a given operation, and at the moment at least nothing more nearly designative of what we want to describe occurs to us than the word "premier." The reason for selecting this appellation will perhaps be more apparent when the equipment and methods of operations are more fully comprehended.



The Tipple and Power Plant



A Corner of the Engine Room

An Extensive Field Is Reached

The shaft is sunk to the Pittsburgh No. 8 seam, and into a block of this splendid coking and gas-producing coal comprising almost 8000 acres in one field. This is to be eventually worked out from the mine in question, or No. 1, and also from colliery No. 2, which is, in many respects, a counterpart of the first. It will be readily admitted therefore that this is a man-sized proposition, particularly since it is the intention of the owners to extract the utmost possible percentage of the coal measures before abandoning the mines.

The entire plant, inside and out, has been arranged with this purpose definitely in view. No. 1 colliery was opened about nine years ago, and the output of the mine is shipped over the Adena branch of the Wheeling & Lake Erie R.R. At the point where the shaft was sunk, the coal lies about 86 ft. below the surface, and while at many points the hills rise above the level of the shaft mouth to such an extent that the survey shows 300 or more feet of overlying strata, yet the mine is nongaseous. The natural dip of the seam at this locality is about 17 ft. to the mile, east.

This colliery is laid out and equipment installed to handle 2500 tons per day. The system of mining is the ordinary room-and-pillar method generally in vogue in this seam, butt entries being turned off at about 450-ft. intervals, with rooms turned off the butts on 33-ft. centers, with 9-ft. ribs between rooms.

Both Mules and Motors Are Used

Haulage of coal from working places to shafts is at present accomplished part by mule and part by motor. One 12-ton, three 6-ton and one 5-ton electric locomotives are used to haul the coal from the partings to the shaft bottom, with 15 mules transporting it from the working places to the partings. Haulage is in no sense difficult in this locality, owing to the even grade of the coal measure.

Undercutting is done by 19 electric chain machines, 17 of them being of the 19-A Jeffrey type. Transportation is accomplished by four hundred and fifty 2¼-ton capacity wood cars. Hoisting from mine to surface is accomplished by a Wellman-Seaver-Morgan hoist with a capacity of four cars per minute. The engines are fitted with a Nicholson overwinding device.

The mine is splendidly ventilated, in keeping with other uptodate measures, by an 8½x16-ft. Cappel fan,

*Aetna Insurance Co., Hartford, Conn.

98,000 cu.ft. of air per minute being produced at a speed of 100 r.p.m. against a 2½-in. water gage. At the shaft bottom and along much of the main roadway and traveling-way is installed a most modern system of lighting and timbering. The comparatively great strength of steel I-beams is here being taken advantage of to protect the roadways and shaft bottoms from falls that would otherwise inevitably cause loss of time and money in a roof as brittle as this. In addition, this gives the space essential to a free movement of men, motors, and animals impossible where wooden supports are employed.

The electric lighting used throughout nearly all the main roads, as well as in the shaft bottom, is an innovation which is fortunately becoming more common. It is still rare, however, in comparison with what it would be if managers and owners of nongaseous mines only realized the wonderful possibilities for economy and safety that lie in a well lighted shaft bottom and main haulage and traveling-ways. We venture the assertion that if this single feature of a modern mine like that under discussion were but properly investigated and understood the stygian blackness of most of our soft-coal mines would in a short time be a thing of the past, insofar as the shaft and slope bottoms, the drifts and the various traveling-ways and the main haulage roads are concerned.

Likewise, the constantly decaying, death-dealing, fall-producing wood cross-piece as generally used to uphold the more or less brittle strata forming the roof of the Pittsburgh No. 8 seam, would give way far more rapidly than it is doing at present to the stauch steel I-beam in wide entries, particularly if the ultimate economy and the present merits of the steel supports were better understood.

Many investigations of the comparative benefits to be derived from the use of the I-beam for this purpose have convinced the writer that its installation is far more generally justified in the interest of ultimate economy, present efficiency and the welfare of the employees than many mine owners will allow themselves to believe.

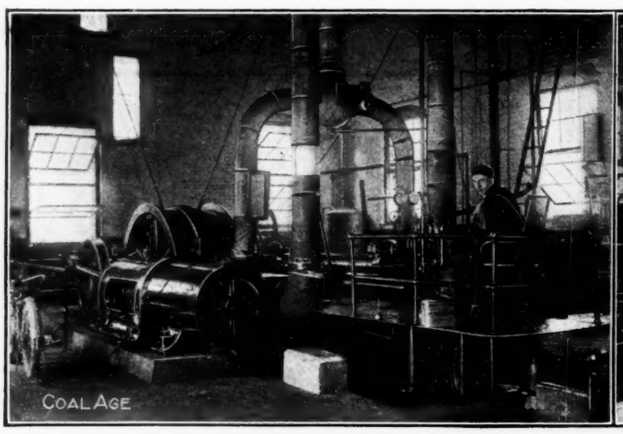
The Tipple Is of Steel

The tipple at colliery No. 1 was designed by George S. Baton, of Pittsburgh, Penn., and erected by the Pittsburgh Construction Co. of the same place. It is built entirely of steel, and is equipped with two Phillips automatic cross-over dumps. Screening apparatus is also provided to produce the following grades: One and one-quarter inch lump, nut and slack coal, run-of-mine and ¾-in. lump.

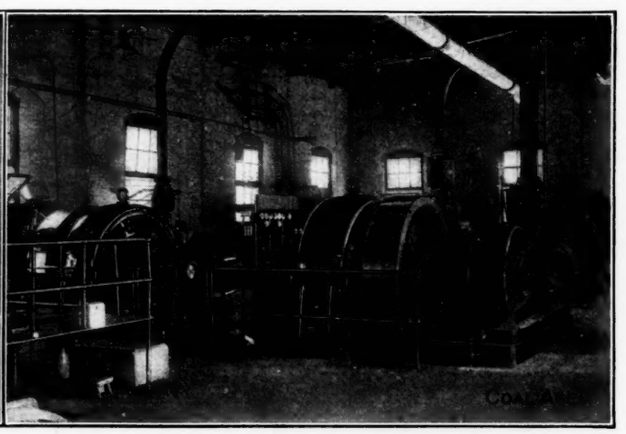
Slate and other refuse is dumped at the tipple and conveyed to the refuse heaps by means of an aërial tramway system, which is an improvement over the method of slate handling generally in use. This slate-disposal system is not considered as being the least of many features installed at this plant with the single aim in view of ultimate economy of operation and present efficiency both combined with speed and safety.

In the matter of power the plant is equally uptodate. Steam is generated by two batteries of 150-hp. Erie boilers, and two batteries of 125-hp. Stirling boilers, the draft being furnished by a brick stack 150 ft. high, and 4 ft. in inside diameter at the top.

Electric current is generated by two 200-kw. Westinghouse, and one 500-kw. Ridgway generators, both being direct-connected to Erie-Ball engines. These machines also supply electric current for the operation of all machinery at Colliery No. 2.



Hoisting Engine at Colliery No. 1



Generators at Colliery No. 1

The mining town in which live most of the employees of No. 1 colliery, is composed of 88 houses of four rooms each, built double, and six 6-room houses for the use of mine officials. All these are of frame construction and neatly painted in gray with white trimmings. Each house is provided with a good sized garden divided from its neighbor by a well-built, neatly painted fence.

The Water Supply Is Adequate

The welfare of the employees and their families is equally well cared for in other respects, the water supply being remarkable for a mining community. This water supply is modern and sufficient for all purposes, a reservoir holding 13,000,000 gallons, having been built under contract by William N. Miller, of St. Clairsville, Ohio. The water from this reservoir first passes through a filtering system erected by W. B. Scaife & Son, of Pittsburgh, and reaches the houses and other buildings under pressure.

The office buildings, engine and generator rooms, boiler and fan houses, and in fact all the mine buildings except the tipple, are built of a buff-colored brick, presenting an appearance quite in keeping with the rest of the plant. The work at this colliery since its beginning has been un-

under the close supervision of Superintendent David Thomas, and general manager, F. Armstrong. Mr. Thomas will be remembered by most mining men of the Pittsburgh field as having been active in the operation of some of the most extensive bituminous mines in that region, including the large Ellsworth colliery. He is evidently a manager who has the happy faculty of combining the conservative qualities of the old-school manager with the enthusiasm and optimism necessary to grasp and utilize all that scientific theory offers an uptodate mine manager. The underground workings are in charge of foreman Peter Dlesk, assisted by Henry Whitlock, and Martin Jalensz.

A complete equipment of mine-rescue apparatus is kept on hand at No. 1 mine, including oxygen helmets and other necessary first-aid supplies. A noticeable arrangement for the prevention of accidents is an automatic safety gate which opens only when the cage is at rest at the ground landing. This is the product of A. J. Allsop, of Jerome, Penn. It is but one of many efforts made by the Provident Coal Co. to conserve the life and limb of every person in its employ.

Experiments with Animals in Carbon Monoxide

By George A. Burrell and Frank M. Seibert

SYNOPSIS—Results of careful experiments indicate that canaries are best adapted for exploration work. Both animals and men may be affected differently by the same proportion of carbon monoxide, and because some animals have an abnormally high resistance to the gas, more than one animal should be used at a time.

The usefulness of small animals in detecting vitiated air in mines is well established. The Bureau of Mines and others have much information on this subject, but in order to make this paper brief, accounts of their practical use or of accidents which occurred because they were not used will not be given here.

The Bureau has experimented with most of the more common small animals, such as canaries, guinea pigs, rabbits, chickens, dogs, mice and pigeons, and finds that canaries or mice are the most suitable for the work. Of the two the Bureau finds canaries to be the more sensitive. They were used in England before their acceptance in this country; presumably in places on the Continent also. Their usefulness in husbanding the resources of breathing apparatus is of great importance.

An additional reason for the use of canaries lies in the fact that they are generally easily obtainable, and become pets of the men who have them. If handled intelligently in rescue operations, they seldom die as a result of their exposure to carbon monoxide.

In rather a brief manner, one of the objects of this paper is to give the results of experiments by the Bureau which have shown that canaries may be used repeatedly in rescue operations without danger of their being more susceptible to carbon-monoxide poisoning after many exposures. This fact had not been determined experimentally hitherto, as far as I am aware. A second important investigation is into the relative effect of carbon monoxide on men and small animals. Carbon monoxide was the gas experimented with because it is that constituent of afterdamp, which is most insidious in its action, most difficult to detect, and responsible for many of the deaths caused by mine explosions. Moreover, small animals feel distress sooner than men in atmospheres vitiated by other gases than carbon monoxide, and so their action in all irrespirable gases will serve as a valuable indication of the presence of those gases when in quantities dangerous to human life.

Note—Paper presented before the Coal Mining Institute of America, Pittsburgh, Penn., Dec. 4-5, 1913. Published with the permission of the Director of the Bureau of Mines.

Effect of Repeated Exposure to Carbon Monoxide

Details of these experiments will be given later in a publication of the Bureau. They will only be outlined here. Canaries, mice and guinea pigs were repeatedly exposed to carbon monoxide under different conditions. In some experiments they were exposed to atmospheres that distress them in about 2 minutes. In the case of canaries, 0.25 per cent. was used in some experiments and the animals were exposed 7 to 10 successive times.

For instance, the animal was exposed to collapse, and then when it had apparently recovered (7 to 12 minutes), it was exposed again and again, the object being to see if, after many exposures to a certain percentage of the gas, they would upon subsequent exposures show distress in a greater length of time, i.e., become more or less acclimatized to the gas. No acclimatization effect was noticed.

The same experiment was performed with mice and guinea pigs with the same result. Other percentages beside 0.25 per cent. were also used in the case of both canaries and mice. The experiments were also carried further to the extent that the same animals that had been exposed several or many times on one day were exposed many times the next day and on successive days.

Animals were also exposed to percentages that quickly distress them, and after removal from the atmosphere and recovery, were placed in atmospheres that ordinarily do not apparently affect fresh animals. This experiment was also reversed, the animals being first placed in atmospheres which do not affect them (for a long time, at least), say 0.10 per cent. in the case of canaries, and then they were exposed to atmospheres that ordinarily affect them quickly, to see if results different from the ordinary could be obtained.

In performing this work, the results of which can be briefly told, but which required considerable time for its performance, the conditions of recovery work with the aid of small animals were kept in view. In such work parties would usually advance until the animals showed distress. The animals would then in all probability be carried back to fresh air, and further advance, if such were made, would be accomplished with breathing apparatus. A general reconnoissance might be made with the animals to define the danger zone of the mine. In the latter event they might be exposed to proportions of carbon monoxide that would in each case cause collapse.

Several Other Possible Contingencies

It may happen, in other cases, that the animals may be first used in a part of the mine where very small percentages of carbon monoxide exist, say 0.10 per cent., a proportion that does not usually seem to affect canaries or mice within one or two hour's time (as far as can be observed) and then they may be used in a place where a larger percentage may be present. It is possible, too, that an animal which collapses at a certain place because of the proportion of carbon monoxide there, might upon recovery be used in an atmosphere containing a proportion that does not usually affect a fresh animal. Finally, the same animal might be exposed over several successive days while a mine was being explored.

It is believed that the experiments performed show that animals will not become acclimatized to carbon monoxide under the conditions surrounding recovery work in mines, and hence become less useful and even a source of danger. It might be mentioned that this question has been raised several times in discussing the use of small animals for detecting afterdamp in mines.

It should be mentioned that two Canadian investigators, G. G. Nasmith[1] and D. A. S. Graham, found that animals finally become acclimatized by continued exposure, i.e., if a guinea pig is exposed for days or weeks to small percentages, it can finally stand exposures that would otherwise kill it, but our tests have shown that in the case of small animals which are quickly removed to fresh air (after distress is shown) and then exposed again for a reasonable number of times, this acclimatization effect is not apparent. The two methods of experimentation are not parallel. It is pertinent to add that the effect Nasmith and Graham observed in guinea pigs—an increase in the red-blood cells—has been observed in men working around blast furnaces, the gas from which contains a high percentage of carbon monoxide.

Effects on Different Animals of the Same Proportions of Carbon Monoxide

The Bureau has performed many experiments in order to draw some conclusions regarding the effect on different animals of the same species of a given proportion of carbon monoxide. It was found that in general a given percentage of that gas affected different animals of the same species in about the same length of time. The results were, at least, closely enough in agreement to justify reliance on the use of animals in mine-rescue work, but once in a while an animal behaved markedly differently from what was expected. This is more true of mice than of canaries, yet even in the case of the latter several of them should be taken with an exploration party.

The Relative Effect of Small Amounts of Carbon Monoxide on Men and Small Animals

In reading over accounts of rescue and recovery work in mines, one is impressed with the fact that some users of small animals have not been entirely satisfied with the behavior of mice and birds (especially mice), because men have apparently felt distress before the animals became affected. The Bureau as the result of many experiments made to determine the resistance of small animals to carbon-monoxide poisoning believes it has the data at hand which explains this dissatisfaction.

It was found, for instance, that almost all of the animals tried, do not show sufficient distress in one hour's time, with 0.10 per cent. of carbon monoxide, to make them valuable for detecting this percentage of the gas. In some cases the length of exposure was extended to three hours without any effects being observed. In one case only was a canary affected in so short a time as 12 min. by 0.10 per cent. of carbon monoxide.

With another bird and the same percentage of carbon monoxide, distress was scarcely observable in three hours. Only a disposition to remain quiet was observed. Eight different canaries were used and six different mice. Only one mouse out of many was slightly affected in so short a time as 30 min. with 0.10 per cent., and even it was not overcome in 4 hours. Neither chickens nor pigeons were visibly distressed.

In an atmosphere containing 0.15 per cent. of carbon monoxide, canaries showed distress in from 5 to 30 min. A mouse showed slight distress at the end of an hour. With 0.20 per cent. canaries responded in from two to five minutes except in one case (35 min.). Three mice responded in 12 min., and a fourth in 46 min. No blood tests were made, the object being to determine the usefulness of the animals for mining work, where their behavior as apparent to the eye is the only guide. Haldane states that 0.06 per cent. carbon monoxide is sufficient to produce distinct symptoms in mice.[2] We do not hesitate to say that because of his greater experience in experimenting with small animals, Dr. Haldane might detect outward symptoms in a mouse that would escape our attention. On the other hand, we have had greater experience than many of those who might use small animals in mines. Further, in the laboratory, observations are better made than in the mine where the light may be poor.

Dr. Haldane made many experiments with himself as the subject in determining the effect of carbon monoxide on men.[3] He found that 0.12 per cent. causes a mouse to sprawl in 11 min. Haldane felt a slight tendency to palpitation in 33 min. In 90 min., he had distinct dimness of vision and hearing and a slight tendency to stagger, besides abnormal panting when he stopped the experiment long enough to run up and down stairs. In two hours' time vision and hearing became markedly impaired and there was some confusion of mind. When the mouse was finally removed from the cage it could not move about. After 18 min. from the time of stopping, Haldane had a distinct throbbing headache which did not last long.

The Minimum Harmful Percentage of Carbon Monoxide

With 0.045 per cent. of carbon monoxide, Haldane did not notice any symptoms in the four hours that the experiment was carried on, but on running upstairs there was unusual panting, slight palpitation, etc. A mouse was not distinctly affected. In defining the minimum harmful or poisonous percentage of carbon monoxide, Haldane states that 0.05 per cent. in pure air is just sufficient to produce in time very slight symptoms in man,

[1]The hematology of carbon-monoxide poisoning. "Journ. Physiology," 1906, Vol. 25, Nos. 1 and 2, pp. 32-52.

[2]The relation of the action of carbonic oxide to oxygen tension. J. S. Haldane, "Journ. Physiology," Vol. 18, 1895, pp. 201-217.

[3]The action of carbon monoxide on man. Jno. Haldane, "Journ. Physiology," Vol. 18, 1895, pp. 430-462.

and the same percentage produces very slight symptoms in mice. He states that 0.20 per cent. is very dangerous to man. With 0.05 per cent. and thereabouts, Haldane finds that the gas finally begins to affect man and the outward signs appear in mice.

Haldane's observations on mice are not entirely in accord with our own researches. The reasons are probably, as already stated, differences in observation. We are convinced from our experiments that in a mine with poor light, and perhaps only hurried examination of the animal, and by persons more or less inexperienced in the actions of such animals, mice and canaries will not usually show distress pronounced enough to give good warning with 0.10 per cent. or less of carbon monoxide. Haldane's work shows that this percentage may finally affect men—a headache in 40 or 50 min. perhaps, or slight tendency to palpitations in less time. This condition will be a considerable time removed from actual distress or unsteadiness of movement. At the end of 20 min., one of the authors had only a slight headache when he exposed himself to 0.25 per cent. carbon monoxide (in air). Later, however, he became very ill. Canaries collapsed in just a few minutes.

In connection with the above laboratory experiments, we have made observations regarding the use of small animals in mines. One instance is noteworthy, as follows:

A mine fire recently occurred and a sample of mine gas was obtained that contained the following constituents:

SAMPLE OF MINE GAS

CO_2	1.10 per cent.
O_2	18.61 per cent.
CO	0.12 per cent.
CH_4	0.42 per cent.
N_2	79.75 per cent.
Total	100.00 per cent.

This sample was obtained in a place where exploration work was being conducted. Canaries carried with the party were not affected, but two of the men finally complained of a bad headache. Later when they went to the surface they became ill. One was indisposed all evening. The birds were with the men continually.

These facts, although they appear damaging against the use of small animals for the purpose proposed, only militate in part against their usefulness. They still remain, in our opinion, the best indicators of carbon monoxide for exploring parties in mines that we have. Canaries will give ample warning of percentages of carbon monoxide immediately dangerous to men. When the proportion of carbon monoxide is 0.15 per cent., canaries will show distress usually in from 5 to 12 min. With 0.20 per cent. the distress is apparent usually in from 2 to 6 min. For distress to appear in men with those percentages requires much longer time, although in the case of some individuals the effects may, when they do appear, last for hours. We have also determined this point experimentally, as have others. Men cannot stand the exposure to collapse from carbon monoxide as animals can. Canaries and mice after distress and collapse recover quickly if exposed to fresh air—only a matter of minutes usually. In the case of men exposed to collapse, recovery is often a matter of days.

Reasons for Variable Effects of Carbon Monoxide on Men

In assigning reasons for the variable effects produced on men and small animals by small quantities (say 0.10 per cent. and under) of carbon monoxide, we would say that it is largely a question of observation. The blood of the animal is, of course, taking up the carbon monoxide, but only slowly and to the extent that even after a long time, one hour or more, the only effect in the animal may be a slight sluggishness or disinclination to move about. Men, on the other hand, especially when moving about or doing hard work, absorb much more oxygen and hence more carbon monoxide than when at rest, and may finally feel a slight or even a severe headache in the same gas mixture that is only slightly or not affecting the animals (as far as can be observed).

The men may even finally become very sick. It is not believed that any pronounced acclimatization effect is produced in an animal on a short exposure which would account for the apparent resistance. It must be remembered that a man is in an excellent position to determine effects upon himself long before distress occurs, in the case of small percentages of carbon monoxide.

When the carbon-monoxide content of an atmosphere is raised from 0.10 per cent. to say 0.15 or 0.20 per cent., the susceptibility of a canary or mouse to the gas is markedly increased, as judged by the action of the animal—so much more than in the case of men that a canary especially may show distress in 5 min., while a man may require 30 or more min. A man, if he exposes himself so long, however, may finally become quite sick, and if he remains in the poisonous atmosphere for longer periods, may become dangerously affected.

The Gas May Affect Different Persons in a Different Manner

The Bureau has compiled data from different sources to show the effects produced on different persons by carbon monoxide. The fact is clearly brought out that the gas may affect different persons in a different manner. Long-standing after-effects produced in people by severe poisoning, although apparently rare, are by no means unknown. It appears to be the evidence usually that recovery from exposure is complete, but that in the case of some individuals long-standing after-effects may follow.

These after-effects on different people cannot be connected absolutely with any degree of exposure, i.e., one short exposure to large percentages, repeated exposures to large percentages as usually happens in the case of blast-furnace gas, or slow exposure to collapse with small percentages of the gas, as in the case of miners exposed to the smaller percentages that are found in mines following explosions.

In the case of the same individual the final blood saturation is what counts. The point is that different people may withstand different degrees of blood saturation. In the case of blast-furnace men, the same men may be exposed to collapse or severe temporary sickness time and again. Usually, as far as can be observed from their behavior, they retain their normal condition, although, as has been pointed out by Thomas Oliver,[4] severe after-effects may linger for two years.

This appears to be exceptional. An Illinois commission appointed to inquire into conditions around steel plants, found it hard to separate effects on steel workers produced by bad living conditions and those produced on some of the men by carbon monoxide, although they were inclined to the view that carbon-monoxide poison-

[4] Thomas Oliver, "Diseases of Occupation," p. 67.

ing had much to do with the generally poor condition of some of the employees. The exact action of the gas in producing severe nervous disorders still remains somewhat obscure. Some do not believe the action so simple as to merely temporarily deprive the system of oxygen, as in the case of suffocation, although most of the good experimental evidence points to this view.

An analogy is found in men who work at high altitudes or suddenly ascend to extreme heights in balloons, where the oxygen tension is very low. Different individuals also may be affected differently at high altitudes. One must believe that in cases both of carbon-monoxide poisoning and oxygen deprivation by other causes, the idiosyncrasy of the individual plays an important part. Others have laid much stress on this point.

Guinea Pigs May Become Immune

As regards acclimatization to the gas, it has been strikingly shown that guinea pigs may become immune. The compensation found in pigs has also been in part observed in men. The red-blood cells increase to compensate for those put out of action by the carbon monoxide. How long this may continue without markedly distressing men is important.

Repeated exposure to carbon monoxide may occur in the case of miners, in those who do the shot-firing. Blasting explosives always produce some carbon monoxide in coal mines. Men may return too quickly to the working face (before gases have disappeared), to examine their shot, and thus expose themselves to percentages, usually small, of the gas. Where large shots are fired where the ventilation is poor, and where the working faces are too far ahead of the last breakthrough, contact by men with harmful percentages of carbon monoxide and other poisonous gases may follow. Miners at some mines frequently go home sick from powder smoke. The general effect of such exposure on them cannot be anything but bad.

Afterdamp Will Differ in Composition

In the conduct of exploration work one sometimes hears it said that certain individuals of a party were able to withstand atmospheres that caused distress in other members of the same party. This may be true because some men are more affected than others by the same proportions of the gas, but one or two other causes must be kept in mind. Afterdamp in different parts of a mine (in some places quite close together) will differ much in composition, to the extent that at one place a very small and insignificant amount of carbon monoxide might be present, while at another place, close by, a harmful proportion might exist. One person in a party unknowingly might encounter the latter atmosphere while his comrades do not.

Another reason usually less apparent to an exploring party has to do with the fact that the amount of carbon monoxide absorbed depends, of course, upon the air breathed. A man at rest may breathe 7 or 8 liters of air per minute. By even moderate exertion this can be increased to 3 or 4 times that quantity. It follows that if one or more members of an exploring party work harder than others they will become poisoned more quickly than their fellows.

Summary

1. Small animals may be used repeatedly in exploration work without becoming less useful as indicators of carbon monoxide.

2. Of the more common small animals, canaries are best adapted for exploration work.

3. Men may feel distress, especially if they work hard, in the presence of small proportions of carbon monoxide (0.10 per cent, or under) when animals at rest in their cages do not show it distinctly.

4. It is found occasionally that different animals of the same species may be affected differently by the same proportion of carbon monoxide; hence more than one animal should be used at a time.

Safety Hook for Miner's Check

In the Langenbrahm mine at Essen, Germany, and in a number of Upper Silesian operations, a clever device for attaching the miner's check to the car has been used with satisfaction. It is described in *Glückauf*, and consists of an iron rod hooked at one end and originally straight at the other. The straight end is thrust through

The Check Hook before and after Insertion in Side of Car

a hole in the side of the car and then bent into a ring which hangs down.

The check can be hung on the hook only when the ring inside the car is free to be lifted. When the car is full the coal holds the ring flat against the side so that no one can tamper with the check. This device is manufactured by the Rheinischen Handelsgesellschaft m. b. H., of Mörs, Germany.

John Lind—Coal Miner

There are probably few people in the country who are aware of the fact that John Lind, President Wilson's personal representative in Mexico, was at one time identified with the Western coal industry. About 20 years ago, Mr. Lind and others, of Salt Lake City, Utah, developed what has later proved to be one of the most enduring and successful of the Western coal operations. The company was organized under the name of the Diamond Coal & Coke Co., the operation being located at Diamondville, in what was then Uintah County, Wyo. Their original opening, No. 1 mine, is still in operation. Some time later, practically the entire capital stock of the company was taken over by the Amalgamated Copper Co., and it has since proved to be the most important and valuable of that company's large coal properties.

Notes on the Clinkering of Mixed Coals

By R. D. Quickel*

SYNOPSIS—Some interesting data on the clinkering of fuel mixtures of different coals at high temperatures, with particular reference to railroad work. The author comments on the well known inconsistencies in clinkering and gives detailed results of some interesting problems he has met with.

The object of this paper is to call attention to some facts, relative to the combustion of mixed coal, the unsatisfactory results sometimes experienced when burning them and the reasons for same. I have also endeavored to evolve some rules whereby it may be determined whether or not clinkering will result when certain coal or coals are burned in a locomotive firebox. The locomotive firebox has been used in the practical and theoretical work connected with this paper, because a locomotive under maximum working conditions generates temperatures higher than are probably generated in any other common combustion chamber.

Some Peculiarities of the Clinkering Problem

As to the clinkering of coals the latest textbooks mention that such a thing occurs, but give no reasons as to the actual cause, although some of them do mention that the ash of the coals have something to do with it.† Every user of steam coal has discovered fuels which would not give him satisfactory results, and large consumers have also discovered that they could not use a mixture of certain coals. In all cases the results were only found after an immense amount of trouble. These errors in purchasing fuel are most expensive.

The fuel-purchasing department of the Queen & Crescent Route discovered years ago that it was impracticable to mix certain coals together and get satisfactory results, and that it was necessary to run actual locomotive tests with the mixed fuel to find out if it would give maximum steam pressure. For instance, we draw our present fuel supply for the Cincinnati, New Orleans & Texas Pacific Ry. from four separate and distinct districts. From three of these districts we can, and do, mix the coal indiscriminately on our coal chutes, while that from the fourth district will not burn without clinkering, if mixed with any of the other coals from the three districts mentioned; in other words, if we were to come to a coaling station with about half a tank of fuel from the fourth district, and were to fill the tender with coal from any of the other three districts, we would, in a short time, have clinker trouble on our locomotives, which would result eventually in an engine failure.

With our present equipment we have found that sometimes either one of the two coals would be absolutely satisfactory when used by itself, but when mixed, these same two coals proved entirely unsatisfactory. We have also found that sometimes certain mixed coals will give perfect satisfaction in our stationary boiler plants, but when used on a locomotive they proved as complete a failure.

As previously stated, actual experience on locomotives has shown that certain coals or certain mixtures of coal will clinker. If we can find any simple method of determining by calculation from a true analysis, involving both proximate analysis of the coal and the ash analysis, whether a coal will or will not clinker, we have discovered something which should be of help, both to the coal dealer himself and the man who buys coal. It has been my experience that a great many coal salesmen fool themselves in regard to their own product.

Today, when a steam coal must stand on its merits with regard to contract based on B.t.u.'s, and ash and sulphur content, a coal salesman cannot know too much about the fuel he is trying to sell. A contract let through misrepresentation, or ignorance, works a greater hardship on the seller, eventually, than on the buyer, on account of the bad reputation given the coal, and those who sell it. Different coals are not all suited for the same purpose, a great deal depending on the drafting, grates and temperatures reached in the various combustion chambers.

Kinds of Clinker

There are two separate and distinct kinds of clinkers formed in locomotive operation. The hard clinker is formed largely by improper firing and the other, known as the molasses clinker, is formed by the fusing together, or slagging, of the coal ash. Improper firing can never be directly responsible for the formation of a molasses clinker, but will undoubtedly hasten its formation. The hard and the molasses clinker differ widely in chemical composition, as is shown by the following analyses:

	Hard Clinker	Molasses Clinker
Silica	56.50	35.04
Alumina	35.20	17.32
Ferric oxide	4.96	37.12
Lime	0.66	7.42
Magnesia	0.83	1.12
Potash	1.14	0.87
Soda	0.43	0.63
Sulphur	1.00	trace
Titanium dioxide	trace	0.50
Total	100.72	100.52

These clinkers differ more widely in their formation and action in the firebox than they do in chemical composition. The hard clinker gives the firebed, in the spot where it is formed, a dead appearance, which stays approximately the same size as when first formed. This clinker can be easily removed by simply pulling it out of the fire, or by turning it upside down or on its side when it is simply disintegrated by the action of the fire. The hard clinker has a tendency to stick together, and will not break when an attempt is made to remove it.

The molasses clinker is altogether a different proposition. When first formed its appearance in the firebox is similar to that of the hard variety, but instead of staying approximately the same size as when first noted, it will continue to grow larger in area. When it covers an area of approximately 4 sq.ft., small blue flames about 3 in. in length will be noticed coming up through it and also at the edges if examined when the engine is working or

*Fuel agent, Queen & Crescent Route, Lexington, Ky.

Note—Paper read at the mid-winter meeting of the Kentucky Mining Institute, Lexington, Ky., Dec. 8, 1913.

†Probably one of the latest discussions on this subject is that by F. R. Wadleigh, which appeared in "Coal Age," Vol. 1, p. 1207, and was supplemented with a discussion by Wm. B. Phillips on page 111 of Vol. 2, and A. Bement on page 218. Another article on the same subject will be found on page 862 of the same volume.—Editor.

with the blower on. This clinker will continue to grow until the entire surface of the firebox is covered. Upon attempting to remove it, we find that it will be soft, as compared to the hard clinker, and as fast as the upper part or crust is taken off it will be noted that the semi-ash underneath has run together like thick molasses.

Examination of the ash pan and fire grates is also surprising. The clinker is found to have run down between the grate fingers and where hardened, hangs from the grate bars in long strings like icicles. Upon attempting to shake the grate, we find this impossible, as the clinker has filled the spaces between the grate bars, and has solidified to such an extent as to prevent any chance for motion in the grate fingers. The only way a clinker of this character can be removed is to clean the entire firebox and build a new fire. Of course, in a case of this character, we have experienced a disastrous engine failure.

For anyone familiar with metallurgy or the principles thereof, it is evident that in the formation of a molasses clinker a metallurgical reaction of some kind has taken place. My attention was first called to the matter of calculating the slags in coal ash by an article in the *Colliery Engineer*, by E. B. Wilson, editor. In this article and a subsequent one, read before the Coal Mining Institute of America, Mr. Wilson advocated the use of Ballenger's Factors in connection with the metallurgical calculations which would be involved in figuring slags from the percentages of silica and the various oxides, as shown in the ash analysis of a coal. I applied these factors in some calculations connected with practical engine tests and found them to give excellent results.

Definition of a Monosilicate Slag

There are more than likely three different kinds of silicate slags formed in the fusing together of coal ash at high temperatures. However, as we are certain of the formation of the monosilicate variety, I will use this slag as typical in the following discussion.

A monosilicate slag is one in which the ratio of the oxygen in the base is to the oxygen in the acid as one is to one. For the benefit of those unfamiliar with metallurgical terms and chemical formulas, the following is given as an illustration of a monosilicate slag, expressed as a chemical formula. The slag formed in this case, formula for which is shown on the right-hand side of the equation, is known as a calcium monosilicate:

Lime + Silica = Calcium Monosilicate

$$2\,CaO + SiO_2 = 2\,CaO \,.\, SiO_2$$

It will be noted that because the silica contains two atoms of oxygen as written on the left-hand side of the equation, to make the ratio one to one, we must use two molecules of lime. Similarly we can write the silicate slags of magnesia, alumina, and ferric oxide, as follows:

Magnesia + Silica = Magnesium Silicate

$$2\,MgO + SiO_2 = 2\,MgO \,.\, SiO_2$$

Alumina + Silica = Aluminum Silicate

$$2\,Al_2O_3 + 3\,SiO_2 = 2\,Al_2O_3 \,.\, 3\,SiO_2$$

Ferric Oxide + Silica = Iron Silicate

$$2\,Fe_2O_3 + 3\,SiO_2 = 2\,Fe_2O_3 \,.\, 3\,SiO_2$$

The molecular weights and the symbols of the various atoms involved in the following calculations may be readily obtained from any international table of atomic weights. The ones given below are only those which will be used in the subsequent calculations: Oxygen = O = 16; magnesium = Mg = 24.36; iron = Fe = 55.9; alumina = Al = 27.1; calcium = Ca = 40.1; silicon = Si = 28.4.

Referring back to the equation showing a calcium monosilicate and substituting the atomic weights, we have the following:

$$2\,CaO + SiO_2 = 2\,CaO \,.\, SiO_2$$
$$112.2 + 60.4 = 172.6$$

From this equation it is readily seen that it requires $\frac{60.4}{112.2} = 0.543$ parts of silica to combine with one part of lime to form a calcium monosilicate slag. The decimal fraction 0.543 is termed Ballenger's factor for a lime silicate. Ballenger's factor for magnesium, iron and aluminum silicates is determined as follows:

For a Magnesium Silicate: Ballenger's Factor

$$\begin{matrix} 2\,MgO & + & SiO_2 & = & 2\,MgO \,.\, SiO_2 \\ 80.72 & & 60.4 & & 141.12 \end{matrix} \qquad \frac{60.4}{80.72} = 0.747$$

For an Aluminum Silicate:

$$\begin{matrix} 2\,Al_2O_3 & + & 3\,SiO_2 & = & 2\,Al_2O_3 \,.\, 3\,SiO_2 \\ 204.4 & & 181.2 & & 385.6 \end{matrix} \qquad \frac{181.2}{204.4} = 0.886$$

For an Iron Silicate (Ferric)

$$\begin{matrix} 2\,Fe_2O_3 & + & 3\,SiO_2 & = & 2\,Fe_2O_3 \,.\, 3\,SiO_2 \\ 319.6 & & 181.2 & & 500.8 \end{matrix} \qquad \frac{181.2}{319.6} = 0.567$$

Ballenger's factors for the principal oxides found in the coal ash are then as follows:

$$MgO = 0.747$$
$$Al_2O_3 = 0.886$$
$$CaO = 0.543$$
$$Fe_2O_3 = 0.567$$

The following is a proximate analysis of the various sections of the No. 4 Blocton coal, in the Blocton field of Alabama; also analysis of the ash:

	No. 1 Bottom Coal	No. 2 Fire Clay	No. 3 Middle-man	No. 4 Top Coal	No. 5 Rash
Moisture	2.00	0.83	0.91	1.33	1.35
Volatile combustible	36.03	7.07	24.36	34.71	17.12
Fixed carbon	58.52	0.72	55.98	57.16	25.98
Ash	3.45	91.38	18.75	6.80	55.55
Total	100.00	100.00	100.00	100.00	100.00
Sulphur	0.76	None	0.23	0.40	0.27
B.t.u.'s	14,150	None	12,405	13,840	Not possible to ignite on six attempts.
Ash Analysis					
Silica	11.34	52.32	28.00	20.40	60.42
Ferric oxide	31.84	5.44	12.64	14.80	3.20
Alumina	13.40	24.20	7.82	11.26	30.24
Lime	16.54	0.50	26.90	26.66	0.72
Magnesia	6.99	1.80	6.93	4.60	0.63
Titanium Dioxide	0.36	0.80	trace	0.64	1.10
Sulphur Trioxide	17.82		2.26	7.97	trace
Potash	0.54	4.22	0.34	0.36	0.80
Soda	0.48	0.35	0.51	0.35	1.36
Ignition		8.91	15.96	13.12	1.30
Carbonate		trace	much	present	none
Moisture		0.83			
Total	99.04	99.37	101.36	100.16	99.77
Fusibility in blast lamp	Fusible	Fusible	Fusible	Fusible	Infusible

This coal was used as a locomotive fuel on the Alabama Great Southern Railroad for a period of two and one-half years, although during its successful performance the fireclay parting was not, to any extent, noticeable in the seam mined during that time. The rash practically amounted to nothing. Upon renewal of the contract with the company mining this coal, and after same had run for a period of about six months, we began to have a great deal of difficulty with clinkered fires. The trouble was traced to the coal, analyses given above, and further shipments refused. An ordinary examination of the coal on the coal chutes, and in cars, did not show any unusual percentage of incombustibles. Closer examination,

however, did show some little fireclay and rash in the product. The owner decided to have this coal washed, and a car was sent to a plant and the entire contents treated. I personally supervised a test of this washed coal on one of our manifest freight trains, with the following result:

A Test of the Blocton Coal

Left Birmingham Dec. 2, 1912, as first section train 77, south, engine 216, with 1360 net tons freight, 30 loads and 1 empty; maximum grade encountered for any distance, 1 per cent.; coal washed and screened over a three-quarter inch screen. A peculiar thing was noted during this test in that no matter how the coal was fired it was impossible to make any black smoke. Of course, black smoke is not desirable at any time, but the fact remains that with the majority of coals, having from 25 to 35 per cent. volatile matter, smoke is easier made than eliminated.

After the engine had been run about 30 miles, it was noticed that there was a slight dropping back in steam pressure, although several times while the engine was in side track at meeting points, the boiler popped off. On a grade known locally as Tuscaloosa Hill, about 55 miles from Birmingham, the steam dropped back to 135 lb., and it was just possible for the engine to pull the train to the top of the hill and roll over into Tuscaloosa. We had a meeting point at Moundville, 15 miles south of Tuscaloosa, and after being in the side track at this point for about 15 min., steam pressure dropped back to 45 pounds.

The first clinker of any size was noted about 40 miles south of Birmingham; it was small and of the molasses variety. The clinker grew rapidly in area, and when the test train reached Tuscaloosa, it covered the entire area of the firebox. During the entire test the slice bar was not used once, and the engine was fired by the most uptodate methods.

At Moundville an attempt was made to clean fire. It was soon discovered that as fast as the clinker was removed, what remained in the firebox ran together again, and it was necessary to knock the fire. The crust of this clinker was approximately 12 in. in thickness. It had been impossible to shake the grates for some time and upon examination of the grates and firebox, we found both completely filled with clinker. A microscopical examination of the coal showed that some of it was impregnated with small partings of fireclay and rash; it was also found in the sample of coal that there was a small percentage of both of these present.

Determining the Trouble

Referring to the analyses of both the coal and the ash, it will be found that as far as the bases are concerned, we may eliminate practically all of them, except those for which we have already determined Ballenger's factors. The sulphur is reported as sulphur trioxide, and it is probable that some part of it will combine with part of the lime, forming calcium sulphate ($CaSO_4$). Assuming that 10 per cent. of the SO_3 combines with the lime, we would have available percentages of lime, as follows:

	No. 1 Bottom Coal	No. 2 Fire Clay	No. 3 Middleman	No. 4 Top Coal	No. 5 Rash
Lime.....	14.89	0.45	24.21	24.40	0.65

As sulphur trioxide is an unstable compound, the chances are that a large part of it will go off in the ordinary process of combustion. As we have also present some little carbonate and potash, part of the SO_3 may combine with the carbonate and potash, forming sodium sulphate, and potassium sulphate.

Taking the factor for ferric oxide, 0.567, and multiplying it by 11.34, or the percentage of ferric oxide present in the bottom coal, we have:

Fe_2O_3 0.567 × 31.84 = 18.05% of silica needed to unite with 31.84% FeO

Similarly,

CaO 0.543 × 14.89 = 8.08% of silica needed to unite with 14.89% CaO
Al_2O_3 0.886 × 13.40 = 11.87% of silica needed to unite with 13.40% AlO
MgO 0.747 × 6.99 = 5.22% of silica needed to unite with 6.99% MgO

42.22 — 42.22% of silica needed to unite with bases present.
11.34% of silica present in bottom coal.

30.88% of silica needed.

Performing similar calculations for the fireclay:

Fe_2O_3 0.567 × 5.44 = 3.08%
CaO 0.543 × 0.50 = 0.27%
Al_2O_3 0.886 × 24.20 = 21.33%
MgO 0.747 × 1.80 = 1.34%

26.02% of silica needed to unite with bases present.
52.32% of silica present in fire clay.

26.30% of silica in excess of bases.

For middleman:

Fe_2O_3 0.567 × 12.64 = 7.16%
CaO 0.543 × 24.21 = 13.15%
Al_2O_3 0.886 × 3.82 = 6.92%
MgO 0.747 × 6.93 = 5.18%

32.41% of silica needed to unite with bases present.
28.00% of silica present in middleman.

4.41% of silica needed.

For top coal:

Fe_2O_3 0.567 × 14.80 = 8.39%
CaO 0.543 × 24.40 = 13.24%
Al_2O_3 0.886 × 11.26 = 9.97%
MgO 0.747 × 4.60 = 3.43%

35.03% of silica needed to unite with bases present.
20.40% of silica present.

14.63% of silica needed.

For rash:

Fe_2O_3 0.567 × 3.20 = 1.81%
CaO 0.543 × 0 .65 = 0.35%
Al_2O_3 0.886 × 30.24 = 26.79%
MgO 0.747 × 0.63 = 0.47%

29.72% of silica needed to unite with bases present.
60.42% of silica present in rash.

30.70% of silica in excess of bases.

By referring to the above calculations, it will be found there is an excessive amount of bases in all but the fireclay and rash, each of which shows silica to be largely in excess, and which would combine with the excess of bases in the bottom coal, middleman and top coal. The chemist also notes that in the analysis of the ash with a simple laboratory blast lamp, all but the rash were fusible.

A summation of the percentages of silica needed to convert all the basic oxides present in the top coal, middleman and bottom coal to a monosilicate slag gives us 49.92 per cent. Likewise we find a total of 57.18 per cent. of silica in excess of that required to convert the basic oxides in the fireclay and rash. Subtracting, we find we have 7.08 per cent. silica in excess of what is needed. This amount of silica in excess need not be considered as it would be removed in the preparation of the coal by washing.

I desire to state here that while this coal did not give satisfaction on locomotives that it did give excellent results as a power-house fuel, the reason, no doubt, being that the temperature reached in the power-house boiler, where it is now being used, is not near as high as that attained under maximum working conditions on a locomotive.

POWER DEPARTMENT

Electricity vs. Steam for Winches

By W. H. Easton

SYNOPSIS—Exact comparative data of steam and electric donkey engines or winches are difficult to secure. This article describes the results obtained by removing the piston rods and gearing a motor to the crank disk of an engine used for transferring coal from barges to a delivery bin.

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One of the difficulties in proving the economy of electric power for donkey engines, winches and similar applications is due to the fact that it is seldom possible to get data on exactly parallel cases. To compare the cost of operation of a given steam hoist with that of a different, although perhaps nearly similar, electric hoist is not satisfactory, and as a matter of fact, both sides of the question have been proved from data of this kind.

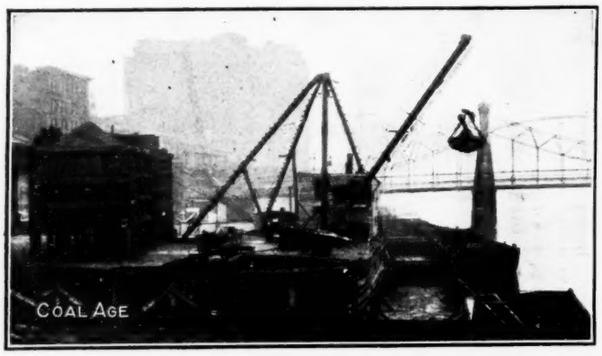


Fig. 1. General View of the Coal-Handling Plant

It is, therefore, gratifying to find a perfectly clear-cut case, where a motor has been directly substituted for a steam engine with no other change in the factors, and where the performance and the cost under both systems are easily obtainable. Such a hoist is shown in Fig. 1. As the illustration clearly shows, this device is used for taking coal from barges and loading it into a bin from which delivery wagons are supplied.

Fig. 2 shows the hoist with the old steam boiler and the new motor. The only change in the hoist was to remove the piston rods and bolt a ring gear to the crank disk, as the illustration shows. A pinion on the motor shaft meshes with this gear, so that the motor application is simple and was made without interfering with the daily operation of the hoist.

The Size and Amount of Work Done

The vertical distance from the top of the barge to the bin is 65 ft. The radius of the swing is 110 ft. and the average length of the swing is 70 ft. The weight of the bucket is 3800 lb. and its capacity is 42 bu., or 3192 lb. The average amount of coal lifted per month is 203,219 bu., or 7722 tons. The motor is a Westinghouse high-torque slip-ring induction machine of 75 hp. capacity. Central station power is used.

The cost to transfer 7722 tons with steam operation was, for coal $60, and for water $15. With electric operation, the cost for power is 1c. a ton, so that the cost for the transferring of the same tonnage would be $77.22, practically the same figure. Hence, electric power is certainly not prohibitively expensive.

Other items must, however, be considered as well as the cost. For the steam engine a licensed engineer is required, whose wages are $125 a month, but a man can be

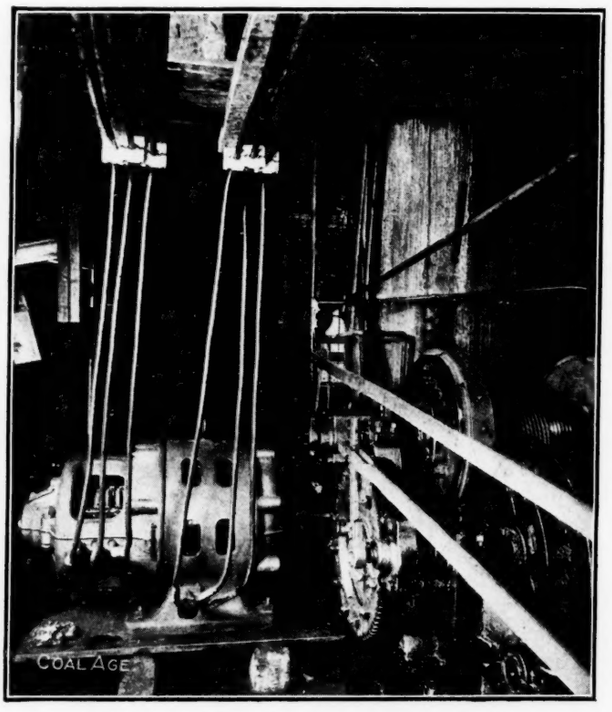


Fig. 2. The Motor Is Geared Direct to the Crank Disk

obtained to operate the electric hoist with perfect satisfaction for $75 a month.

Furthermore, the steam hoist required 60 sec. to make each trip, whereas the electric hoist, because it can be accelerated more rapidly, can make a trip in 50 sec.—a 20 per cent. increase in production. Hence, for a full 10-hr. day, the electric hoist can make 120 more trips than the steam hoist and can transfer 5040 more bushels of coal.

The motor is more reliable than the engine, requires little oil and no water, is always ready to operate without waiting for steam to come up to pressure, requires no attention when not in use, and has nothing to freeze up. Hence with the electric hoist the cost of repairs and maintenance will be less and there will be fewer delays and shut-downs. The relative cost of electric operation will, therefore, be less and the production greater than the figures given above.

A Portable Substation

The Berwind-White Coal Mining Co., of Windber, Penn., has recently added a 400-kw. Westinghouse portable substation to its equipment, and is making an interesting use of the same.

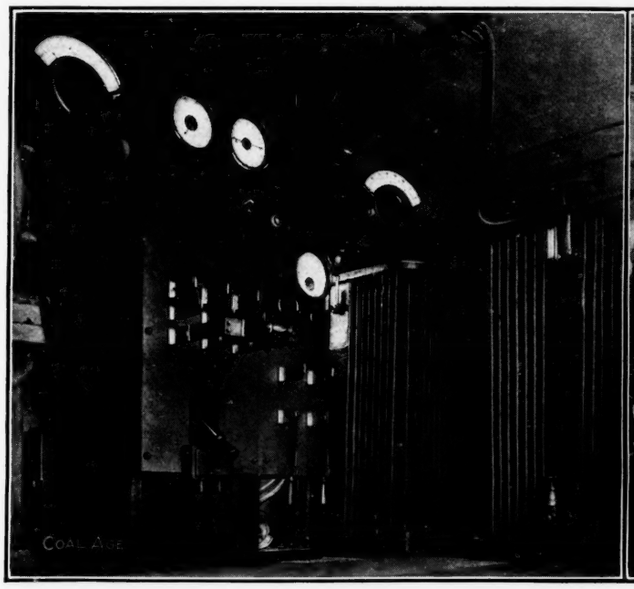
mitted efficiently only as alternating current at high voltage, and then converted into direct current at the substation for use underground.

The Berwind-White Co. is developing its outlying properties at a rapid rate and needs direct current at points where permanent substations have not yet been erected.

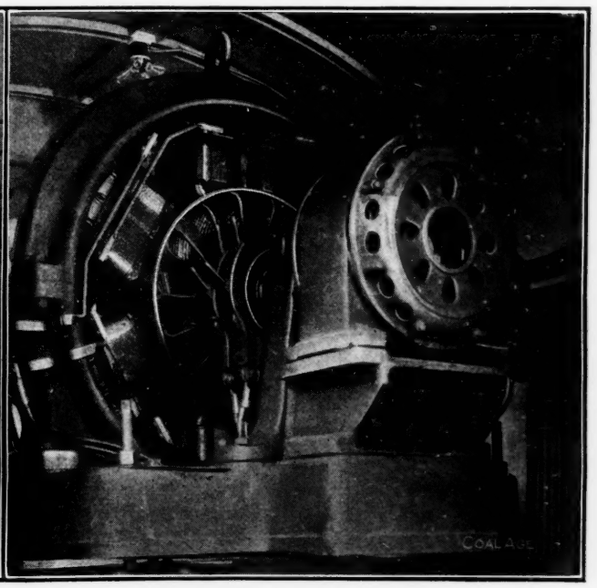
THE PORTABLE SUBSTATION ON A SIDETRACK

As is well known, a substation consists of apparatus for changing alternating current into direct current and is generally necessary in mining work, because direct current must be used for haulage but cannot be transmitted economically over long distances. Hence, when the mine is located at a point remote from the power station, from which it draws its supply, the electric energy can be transmitted efficiently only as alternating current at high voltage, and then converted into direct current at the substation for use underground.

The portable substation was therefore decided upon in order to prevent delays in development. This substation has the same equipment as that of a permanent installation, namely, transformers to step down to a moderate voltage the high potential of the current received from the transmission line, a switchboard and a rotary converter, which receives alternating current and delivers



THE TRANSFORMERS AND SWITCHBOARD



THE ROTARY CONVERTER

direct current. This apparatus is all mounted in a car resembling an ordinary freight car.

The Portable Substation in Use

When work at a new development reaches the point where direct current is necessary, the portable substation is hauled to the workings, connected to the transmission line and put in operation generating the necessary direct current. When the permanent substation is completed, the portable one becomes unnecessary and is taken to the next development.

A further use for this substation is to provide insurance against shutdowns. If accidents occur at any of the permanent substations, the portable one is sent to carry the load until the necessary repairs are completed. One substation of this character, therefore, is practically the equivalent of a duplicate set of apparatus at each permanent installation.

Use of Gasoline Motors in Mines

By W. C. Whitcomb*

SYNOPSIS—An elementary article on the gasoline motor, showing how to compute the size of the locomotive, the weight of the rail and the velocity of the air current in which it should work. The author says that some expert inspection should be provided and urges that gasoline haulage is not unsafe if proper precautions are taken.

It must be some 12 or more years ago that the St. Bernard Mining Co. tried out a gasoline motor built by a man named Prouty. This machine was crude and was not a success. Other attempts to produce a workable locomotive were made in West Virginia, Pennsylvania and Illinois; none of which were permanently successful.

There is nothing mysterious or uncertain in regard to the use of gasoline motors in mines. The problems to be considered are the same as those presented by any mechanical system of haulage which depends on the tractive resistance of the rail for its hauling capacity. First: The local conditions should be thoroughly studied and profiles should be made of the haulage ways, showing grades, etc. The number of tons to be handled per day and hour should be carefully ascertained, the length of haul measured, the time required to make a return trip carefully estimated and from these data the number of cars it is necessary to handle per trip can be decided. Then we can ascertain the total weight of trip, figuring in the weight of both car and load and check the profiles to see what the grades are both in favor of and against the loads and empty trip. Then we decide on a motor with enough weight and power to handle the trip against the grades with a liberal margin of reserve.

Car Friction and Gravity Resistance

Ordinary mine cars will require from 30 to 40 lb. pull per ton to move them on a level track. The horizontal tractive resistance of modern cars in good condition may drop down as low as 20 lb. per ton, but it is not safe to figure much less than 30 to 35 lb. per ton on the level. For each 1 per cent. grade against the load, 20 lb. per ton must be added. For example, if a car will move on 30 lb. per ton pull on a level, it will require 30 + 20 or 50 lb. pull against a 1 per cent. grade, or 30 + 20 + 20 or 70 lb. pull against a 2 per cent. grade.

I mention these points, as an operator is apt to say his hauls are "practically level" when he may have places with 1 or 2 per cent. grades against the loads and cannot see why his motor is not giving the results unless he has his profile and knows what he is doing.

Again, when working against grades, the pull required to move or pull the cars not only increases, but the draw-bar pull of the locomotive is less as the motor has to pull its own weight up the grades.

Draw-Bar Pull Calculated as One-Fifth Weight of Motor

I ordinarily figure that a motor will exert a draw-bar pull equal to one-fifth its weight in pounds when working on a level and on dry rail of proper weight for the motor, but from this draw-bar pull exerted on a level we deduct 1 per cent. of the weight of the motor in pounds for each 1 per cent. grade. For example, a 5-ton motor will exert a tractive effort, or draw-bar pull, on the level of one-fifth of 10,000 lb., or 2000 lb. Against a 1 per cent. grade, we would have 2000 lb. less 1 per cent. of 10,000 lb., or 2000 less 100 lb., or 1900 lb., net; or 1800 lb., net, against a 2 per cent. grade, etc. We must not assume that the hauls are "practically level," but know what the grades are and make allowance for them.

Each Rail Should Weigh 4 Lb. per Yard for Every Ton of Weight of the Locomotive

Without the use of a formula, we roughly estimate that it requires a rail that will weigh at least 4 lb. per yard for each ton of weight in the locomotive. For example, a 4-ton motor should run on a 16-lb. rail; a 5-ton on a 20-lb. rail, etc. This rail should be well laid and connected with fishplates. Low spots should be avoided. Switches should have long, easy points; curves should be as easy as possible, for the shocks and strains on a track increase about with the square of the velocity, and with mechanical haulage you not only get greater weights but higher speeds. Therefore, what might be a good track for mules is a poor track for locomotives.

These points are common to all mechanical haulage. I raise them as there is some tendency among operators to think that because a gasoline motor is a self-contained and independent unit, it is not necessary to make as much preparation for putting it in operation as with other systems of mechanical haulage, and to a certain degree, they are right, as it is not necessary to bond the rails or to line up the trolley wires with the track, etc., but good track conditions are essential to success with any system of mechanical haulage.

*General manager, Geo. D. Whitcomb Co., Rochelle, Ill.

Note—Article read before the Kentucky Mining Institute, Lexington, Ky., Dec. 8, 1913.

The Effect of the Gasoline Motor on the Mine Air

Much has been said about their effect on the mine ventilation and the danger of using gasoline motors. The former difficulty is easily removed. A gasoline engine will exhaust a small quantity of gas and of this discharge the most important impurity is carbon monoxide, as it is a dangerous gas, and a very small percentage in the air is injurious to the men in the mine. With an engine working properly there is little monoxide formed. The amount will vary with the quantity of gasoline consumed. There is no satisfactory or practical way of absorbing or neutralizing carbon monoxide. Carbon dioxide can be absorbed to a certain extent by lime or caustic-soda solutions and by plain water, and the objectionable odor can be taken out of the exhaust by running it through a lime solution or through water, but the only satisfactory way to make conditions safe and pleasant is to supply enough air to dilute the exhaust until it is harmless. This is not a difficult matter and in any mine with uptodate ventilation, it is already provided to a large extent by the requirements of the law, as the statutes call for a certain amount of air for each man and animal in the mine, and this volume in workings large enough to use a motor will so thoroughly dilute the gas that it will be below the danger point and so low that it cannot be detected by chemical analysis, but if more air is required, it can easily be forced through the entries.

As before stated, the percentage of exhaust gas will vary with the gasoline consumed. Therefore, you can figure on the amount of air necessary by taking the average gasoline consumption, or you can figure the maximum amount of gasoline that can be burned in the engine used on a motor. I normally figure on an engine of at least double the average horsepower used, for in starting a trip there is a heavy load and occasionally heavy grades are encountered. But where there are grades there is a heavy pull when traveling in one direction and practically none when passing over the road on the return trip; therefore, grades do not increase the average consumption to any large extent, but they do add to the quantity of fuel used for a short time.

800 to 1000 Cu.Ft. per Ton per Min.

We have found that when the consumption of gasoline is at its average, if there is from 800 to 1000 cu.ft. of air per minute per ton of weight in the motor passing through the entry where the motor is working continuously, the exhaust is not noticed and is unobjectionable. The smaller ventilating current recommended is suited for the intake and the larger for the return airway. If a motor only makes an occasional trip into an entry or working place, a small air current is sufficient, just enough to insure circulation and carry the exhaust out before the next trip of the motor, so that the exhaust will not accumulate. If you figure on the maximum gasoline consumption possible in the engine it would require about double these amounts, but as before stated, it is almost impossible to use the maximum under ordinary conditions.

For example, on our 7-ton motor, we have an engine capable of developing 50 hp. when running 500 r.p.m. On a brake test, this engine would probably burn about a pint of gasoline per horsepower per hour, that is, 50 pints or 6¼ gal. per hour. At this rate, this engine would burn 50 gal. of gasoline in an 8-hr. day, while the facts of the case are that the average gasoline consumption of this motor will run from 15 to 18 gal., showing that the average horsepower developed is from 15 to 18 hp.

The large engines, however, are more economical than smaller engines as they permit the work to be done on high gear and at slow engine speeds. You have all seen, no doubt, the same results in your automobiles. If you are running on direct drive, your gasoline consumption is low but if you get in mud and have to shift into second or third gear, your engine is running fast and the gasoline consumption increases.

Why Estimates Should Not Be Based on Full Power

I mention this point of gasoline consumption as there is a tendency to figure on what gas might be thrown off if the full power of the engine was used all the time rather than on the actual amount. It would hardly be possible to use the full power of the engine all the time, for if grades, etc., required it in one direction, there would be little or no power required in the opposite direction. For example, take a 4000-ft. haul with a heavy grade against the load all the way. To come up this inclination under normal speed would require say, 10 to 12 min. under three-fourths full power. To switch, hook onto empties, etc., would take 1 to 2 min.; to come back with the empties, 10 min.; to switch and couple to loads, 1 to 2 min. Therefore, we would have, say a total of 22 to 26 min., with 12 min. under, say ¾ full load, 3 to 4 min. under little or no load and 10 min. on return trip under ¼ load, so that even under such conditions the average would be less than ½ load.

Experience Needed for Locomotive Operation

There has been a tendency to consider gasoline motors unreliable. This has been to a certain extent true in the past, but with the present development, there is little excuse for not getting as good and consistent results with gasoline motors as with any other system. However, a gasoline motor will not run itself nor can it be put into the hands of an inexperienced man and be run indefinitely without care or attention.

Gasoline-driven machines have received a great deal of unjust criticism and blame due to the fact that they can be placed in the hands of an inexperienced man after a few hours' instruction and he can operate them. We see automobiles, auto-trucks, etc., not to mention gasoline mine motors, operated by men who know but little about the mechanical construction of these machines or their requirements. They know how to charge them with gasoline, how to oil them and how to turn the crank to start them, but nothing further. This is all right if there is someone back of them to examine the locomotives occasionally and to see that they are kept in order. But very often, especially with mine motors, because they are self-contained and independent, such a man is left to run and care for the machine and while often he is willing and anxious enough to give satisfaction, yet due to his lack of experience he is unable to do himself or the machine justice.

If an electric plant is installed, it requires an engineer, an electrician and a wireman, all in addition to the motorman. A compressed-air plant needs an engineer and a pipeman, as well as a compressed-air locomotive engineer. Hence why should not provision be made for the in-

spection and care of gasoline motors by someone other than the motorman? Inspection is not required every day but the old adage, "a stitch in time saves nine," applies to gasoline motors. They will probably run for months demanding little or no attention other than to put in gasoline, oil and water and tighten up a bolt or nut occasionally, but they will sooner or later require attention. The same is true of a boiler, engine, generator, compressor or any other machine performing a large amount of work, such as a gasoline locomotive does, but the conditions under which the latter works are more adverse. Where systematic care and attention are given, gasoline haulage is just as reliable as any other system.

Safety from Explosion

Many operators fear to use gasoline in mines. This fear is well founded unless proper precautions are taken. We have so designed our motors that the tanks cannot be filled when on the locomotive, yet can be sealed or closed when off the motor. Handles are provided for carrying the tanks and the weight of a tank, is such that one man can carry it. Four tanks are furnished, two to be carried on the machine and two to be sent outside the mine.

Either tank can be used separately for running the engine, so that the operator can use up one tank, switch over to the other, send the empty tank up and have a full one come down, which he could pick up on the next trip, and always have a reserve tank on the machine and two reserve tanks on the surface. These tanks should be filled at an oil station away from the shaft or tipple, so that the gasoline is handled around the tipple and below ground in sealed tanks exclusively.

They are so placed on the motor that they are protected on all sides by heavy iron covers. By this system, danger is eliminated. Between each tank and the engine are two shut-off valves so that in case of an accident, the gasoline can be shut off at two different points for each tank. This system has worked out very satisfactorily, and although there are over three hundred of our motors in use, we have not had any trouble from this source.

Ignition of Gas or Coal Dust

So far as igniting gas or coal dust, I think there is no question but what gasoline motors are much safer than electric motors as the exhaust from a gasoline motor passes through a large muffler or cooling box and is finally discharged near the ground while the electric motor is apt to give off sparks or electric flames either at the track or at the trolley wire near the roof where gas would accumulate.

Gasoline motors have only been used in mines in a practical way during the last four years. Great improvements have been made and more will naturally follow, but today, with equal conditions and care, the gasoline motor will undoubtedly give as cheap, if not cheaper results with less cost of installation than any other system and is the most flexible haulage which can be installed, as all that is required in making extensions is to put the track in shape. When not in use the gasoline motor can be put on one side in a dry motor stall and will not require care or feed and when ready to start it is not necessary to see that boiler, engine, trolley wires, rail bonds, pipe lines, etc., are also ready. The gasoline motor has taken its place in mine haulage and as it is better understood it will be more appreciated.

The Storage of Anthracite Coal

The storage of anthracite coal is a subject of which the public knows little and indeed on which accurate information is not easily obtainable. The fact that storage is a source of considerable expense to the operating companies is also a matter of which most persons are entirely ignorant. An authority on the subject estimates the amount that may be in storage at one time at about 10 per cent. of a year's marketable production, or say 7,000,000 tons, at tidewater and interior points. At the present time coal in storage is about at the maximum.

One coal company has storage facilities with a capacity of 2,000,000 tons. At one of its plants provision is made for 480,000 tons, at another for 383,000 tons. More than 125,000 tons can be stored at a covered plant in South Chicago. The Schuylkill Haven yard of the Philadelphia & Reading Coal & Iron Co., has a capacity of 1,000,000 tons, and that at Abrams a capacity of 600,000 tons. This stored coal must be hoisted, when needed, out of the Mahanoy Valley over Broad Mountain. The pair of hoisting engines installed for this purpose could hoist three "battleships" and will develop 5000 hp. while doing it.

The expense in storage involves not only the cost of handling the coal several times, but the loss that results from breakage, which is the chief care of the employees in charge of this branch of the anthracite-coal business. There is also a considerable investment in hoisting machinery. In addition, the huge conical piles of coal are subject to freezing, and when they get in that condition the only way the coal can be handled is to break it up by pick and shovel gangs, which is not only expensive work, but damages a good deal of coal.—*Philadelphia News Bureau.*

Copying Old Blueprints

A writer in the *American Machinist* has the following to say regarding a method for rehabilitating old blueprints:

There is often trouble, in drawing offices, in having some old blueprint record creased and hardly decipherable. To work from it is not advisable for it might become torn and made even more indistinct than it is at present. The draftsman cannot trace it because the lines are too indistinct to look at through the tracing cloth and redrawing it would be a rather costly item.

I had an instance of this recently where an individual brought me an ancient blueprint, the only record, and desired me to duplicate it. After a little experimenting with another blueprint, I found that if the white lines on the print were inked over, a very presentable blueprint could be obtained from exposing this as one would a tracing. So I went ahead and inked over the white lines on the old blueprint with india ink. This, as you can imagine, was very much easier than tracing it. When this was finished, I placed the print in the printing frame and obtained several blueprints from it as if from a tracing.

Erratum

In Fig. 5, on p. 851, of our Dec. 6 issue, to the left of the figure, the words occur: "A grounded armature is found, lamps out." This should read: "A grounded armature is found, lamps light."

A fireboss who was going up over a roll, and who had tested the face of a crosscut with his safety lamp, called down to the workmen waiting below with naked lights: "There's a bit of gas here, so don't youse all come up; only one of youse come up here with a light."

EDITORIALS

The Source of Public Scientific Conceptions

In the earlier days of the rescue apparatus, the question was often raised whether breathing pure oxygen was not dangerous to life. The prevalence of this idea in official and other quarters led Prof. Gustav Gärtner, as he tells us in the "Dräeger Hefte," to investigate its authority.

Extensive search in scientific textbooks failed to elicit such an opinion, barring the fact that oxygen was shown to be dangerous if it exceeded the pressure of two atmospheres. At least Prof. Gärtner heard the same opinion advanced by his young nephew and demanded the source of his information. "I have read it in a romance of Jules Verne," answered the boy. "Twenty Thousand Leagues under the Sea" was the lad's authority, and also, as investigation showed, this same book had created in him many other notions.

Verne represents that oxygen breathing intensifies, but shortens life like the burning of a candle. It is the same scientific treatise which, if distant recollections may be trusted, represents that a submarine boat can be run on current generated in Bunsen batteries. Few, doubtless, of the many who have read this and other works by the same writer have ever doubted the accuracy of the information contained therein. Many popular ideas have originated in just such an unreliable manner.

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A Discrepancy in Coke Statistics

For a great many years the statistics of Connellsville coke, compiled weekly by the *Connellsville Courier,* have been accepted in the coke and iron trades as worthy of serious consideration. Reflecting on Disraeli's remarks regarding the three kinds of inveracity, of which statistics is one, we are disposed to apply such checks as may appear likely to disclose possible irregularities.

The *Courier* presents weekly two sets of figures, one of coke production in the Connellsville and lower Connellsville regions, and the other of shipments from those regions. Normally the divergences between the two are slight, as certainly they should be, for it is quite unusual to stock coke at the ovens. The extra handling is expensive and damages the coke to such an extent that buyers usually object to receiving stock coke except in emergencies. As a rule, too, it is unecessary, for the production of an oven can be regulated to a certain extent by varying the number of charges in the week.

Observing a tendency in the past few months for the reported shipments to outrun the production, we took pains to add up the respective figures as reported since July 1 to date, in the 24 weekly reports, and find that the shipments exceed the production by more than 65 thousand tons. Assuming that the statistics are precisely accurate, and that the region is entirely bare of stocks now, it is apparent that there must have been some 65,000 tons in stock on July 1. At that very time, however, it was claimed that the operators were being careful not to accumulate stocks, but rather to restrict production to the absolute limit of demand.

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"What It Is—What It Does

The words above are quoted from a caption in the reply of the United Mine Workers of America to the statement of the coal operators of Colorado. We shall not copy here all the good works accredited to union activity but note only two of those presented. The circular states that: "The union has made life safer in the mines so that the death rate in unorganized workings is three times greater than in those where the union is recognized. It has been the greatest power in the country in preventing strikes in the coal mines. Wyoming, for instance, has had no strike since it became organized. The coal miners and operators deal with each other in peace and harmony."

We have always been advocates of the right of the miner to form a union and have never been blind to the advantages which might accrue to operators, miners and the public from such an organization, and we are glad to see that the union is boasting that such results have been already accomplished. The statement quoted shows that the leaders in that movement believe that the union *should* secure safety and promote industrial peace.

Of course, the organization should do even more, it should guarantee excellence of work and efficiency and it should lead in promoting domestic comfort and high ideals of citizenship among its members. But after reading the quotation above, we cannot refrain from congratulating the union or having a clear comprehension of a part, if only a part, of its duty to the men, the operators and the nation.

But we can only write these words of commendation by being utterly blind to the wilfulness with which the United Mine Workers of America have misrepresented the real facts while they rightly define their proper mission which they have left unfulfilled.

There are so many states in which the union is weak in some parts and strong in others that a comparison based on an estimate of states as a whole would give unreliable results and it would besides overlook the inherent dangers of mining in various localities, thus defeating any attempt to draw a correct inference from statistics.

But we are certainly safe when we make the declaration that the United Mine Workers of America have opposed themselves to the safe conduct of mines. The organization has, it is true, aided in passing laws involving expense and trouble to the operator, but on the other hand it has repeatedly sought legislation which permitted the shooting of coal from the solid and only in nonunion states are convictions obtained against miners for violation of the laws of safety. Its strong opposition to all attempts to discharge violators of safety rules has led to repeated accidents. In fact, the union, like other *ex-parte* bodies, works for the reform of the other fellow and labors equal-

ly hard to maintain such evils as make it popular with its supporters. It has been equally active in the seeking and the nullifying of legislation; so perhaps its virtues and failings on the whole counter-balance.

As for promoting industrial peace, it has never done this. Its existence involves a strike or a suspension every year or so when the schedules are rearranged. We consider it, therefore, rather a guarantee of industrial war than as a pledge of peace. But if it would only keep its agreements in between these periods of rearrangement, it might claim to prevent some minor labor troubles but unfortunately its contracts are not kept. The Anthracite Conciliation Board, after noting some two or three hundred strikes in the anthracite region made by union men to obtain privileges which their contract did not give them, instructed one operator to discharge three of his labor leaders. The operators of central Pennsylvania in a meeting called at Philadelphia for that special purpose, have served notice on the miners that they will withdraw their recognition from the union, if that body does not cease its unwarranted strikes to obtain ends other than those provided by the contract, which both parties have signed. These two facts will show how little is to be gained by agreements with the union as now constituted.

It is said that a standing army insures peace, but most of the warriors of the United Mine Workers of America are only paid by that organization in times of war or disagreement and when everybody is working peacefully the occupation of the pit committee is gone. So this body seeks an occasion for a quarrel and sedulously endeavors to make a *new* contract as the operator obstinately refuses to give them an excuse for trouble by breaking the one he has signed.

But these are not essential parts of union activity. If the organization were in other hands we believe it would not necessarily be useless to its members, the operators and the public. Some changes could be made which would insure a greater degree of peace. The meddlesome pit committee which is an unutterable nuisance should be abolished. It is paid only when it gives trouble and, if at all venal, it can arrange to annoy the operator all the time. Under stricter supervision by the paid officers, the local committee could be made at least cognizant of its duty even if the policy of the union did not permit of its entire suppression. There should be no countenance given by the union to strikes other than those which are declared for the purpose of enforcing agreements, and suspension from the union should follow all unauthorized striking. As the operators but rarely seek to evade their contracts, there would be almost no occasion for strikes or suspensions.

The union should show itself as much interested in aiding all good movements as that local union at Gillespie, the good deeds of which will be found set forth in our sociological department of this week. A few years ago the business man did not regard safety provisions as incumbent on him. He thought that his duty was done when he avoided using dangerous devices and kept his machinery in condition. Today he lays his plans for safety with consummate care. The union, however, is just as callous today as the operator was in years gone by. A few years ago the propaganda of safety was regarded as none of the business of the industry. It is now thought to be none of the business of the union, but we venture to think it will eventually be regarded as a leading obligation. Even the organization cannot safely oppose itself permanently to the spirit of the age and to the needs of its members. The fact that it loudly proclaims that it is moving in that direction gives us hope that we shall in time be able to see evidence of its progress.

The Mine Foreman Certificate

Complaints reach us, from time to time to the effect that many mine foremen holding positions of responsibility with certain coal companies have failed to comply with the requirements of the state mining law, in regard to the certification of mine foremen. In some cases, it is claimed that the man holding such a position does not even possess the certificate required by law; but, more frequently, the claim is made that the certificate was secured through improper means. Occasionally it is stated that the man holding the certificate has not taken out his naturalization papers and is not, therefore, a citizen of this country or eligible to the position of mine foreman.

There is nothing more discouraging to the man who is the honest possessor of a certificate entitling him to hold a position as mine foreman, than to know that present incumbents of the office he desires have no certificates, or have obtained their certificates through dishonest means and are not legally entitled to the same.

We know that, in many cases, state mining boards have attempted a more or less thorough investigation to ascertain, if possible, what certificates are wrongfully held. We have known of cases, in the past, where the mine inspector has notified the coal company that a mine foreman in their employ must secure his certificate by a certain date or give up his place. In some few cases, a mine foreman of long experience and acquaintance with the mine of which he has charge has been permitted to continue to serve in that capacity for a stated time, which would enable him to prepare himself to pass an examination and secure a certificate as required by law.

In some states, the mining law provides for what is termed a "service certificate," which makes it legal for a man to continue to serve the same company, in the same capacity, as long as his service is satisfactory. The service certificate was provided to avoid the possibility of a law requiring certification, proving a hardship and an unjust burden on the man who had served successfully for a number of years in his present position. The time has largely passed now, in most states requiring the certification of mine foreman, when such a law will work a burden on men holding that position. The fact is generally recognized that it is not only desirable, but absolutely essential that all mine foremen should be men possessing not only practical experience, but theoretical knowledge of the principles of mining.

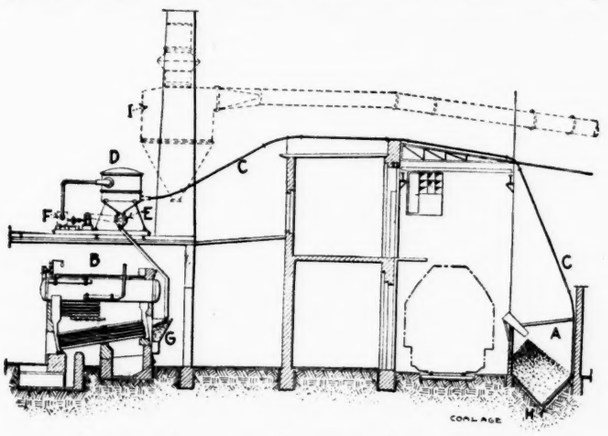
COAL AGE would not assume to impugn the honesty of any member of an examining board; but there is unquestionably grave doubt as to the thoroughness of many examinations to determine the competency of candidates for the position of mine foreman. Mine examining boards are strongly urged to consider the growing need of a fuller knowledge of theory and principles in mining, on the part of candidates, for all positions of trust and responsibility. Let everything possible be done to raise the standard and increase the efficiency in this department of the work. In this way only will the certificate of competency continue to be of value.

Pneumatic Plant for Transporting Coal

The pneumatic transportation system employs directly exhausted power or compressed air (or both successively) to convey the material in tightly closed tubes; it has been used for about 15 years,* for moving valuable raw materials, such as grain, malt and chemicals. In spite of its three- or four-fold power consumption, it had the advantage of saving losses in dust of the product.

The pneumatic transportation of low-grade materials, such as sand, coal slag, ash and refuse, has recently begun to assume economic importance. The process has been considerably improved and coal up to nut size is now handled; and especially the dangerous coal dust may be conveyed safely and without economic disadvantage.

The plant here described transports nut coal to the boiler house with entire satisfaction. It was built by



SKETCH SHOWING GENERAL ARRANGEMENT

Simon, Buhler & Baumann, Frankfort on the Main, for their own use.

As shown by the illustration, the coal shed *A* is at some distance from the boiler house *B*. The transportation of the nut coal in hand trucks or barrows across the shipping track was inconvenient, owing chiefly to blockage of the way by freight cars. The pneumatic system avoids this difficulty. A pipe *C* was run from the coal shed over the railroad track, and storage building directly to the place of use. Above the boiler house is the vacuum receiver *D* with discharging device *E* and an electrically driven air pump *F*, so that the coal is brought directly into the hopper *G* in front of the automatic stoker. By means of the motor starter, the fireman in the boiler house can start or stop the transportation.

Since the coal is bulky, the suction mouthpiece *H* in the shed cannot automatically suck it up as in the case of grain and other granular material, but a special arrangement must be employed which enables a completely automatic service. In the transportation tube the coal moves with considerable velocity, and when passing curves, rubs on the tube walls. Curves are, therefore, to be avoided so far as possible, and where indispensable they should be gentle ones. At the entry into the vacuum receiver care should be taken that coal drops upon coal, since otherwise it breaks up into dust and becomes unsuitable for grate firing. Discharge tube and chute must be as short as possible.

The coal collecting in the vacuum receiver *D* sinks through a steep funnel bottom to the discharging device *E*, which cuts it off from the vacuum. It consists of a cell wheel turning at about 10 r.p.m., and emptying the coal in small quantities. The coal dust forming in the receiver is caught on screens and by shaking with a hand lever the coal is resized.

For large plants a wet filter is recommended, that is, a reservoir filled with water to a certain height. The air containing coal dust is sucked through and thus cleaned. The slime thus produced is drawn off into certain chambers, dried and briquetted.

The furnace can also be fed automatically by a chip or sawdust-conveying plant *I* of about the same power. The movement of the air is produced in the plant described by a rotary blower *F*, belted to a 6-hp. electric motor. The quantity of coal conveyed is about 6½ cu.yd. per hour. The force of the air current, even at a speed of 65 to 100 ft. per sec., is so great that chains and electric-lighting fixtures from grain ships are sucked up. Velocities up to 150 and 200 ft. per sec. have been reached in pneumatic transportation plants.

*Much longer in the United States.

Note—Translated from an article in "Gluckauf," by Prof. M. Buhle, of Dresden, Germany.

Recent Legal Decisions

By A. L. H. STREET*

Miner's Lunch Place as Place of Employment—A coal miner while eating lunch in the mine within 4 ft. of his place of work was acting within the scope of his employment, so as to charge his employer with liability for injuries resulting from a fall of rock from the roof. (Indiana Appellate Court, Domestic Block Coal Co. vs. Holden, 103 Northeastern Reporter, 73.)

Nondelegable Character of Employer's Duty—An employer cannot avoid responsibility for injury to a worker, arising from failure to provide a reasonably safe place of work, by delegating performance of such duty to some particular employee. (Oklahoma Supreme Court, Great Western Coal & Coke Co. vs. Malone, 136 Pacific Reporter, 403.)

Scope of Coal Mining Co.'s Powers—Charter power given a corporation to engage in mining, coking and selling coke and coal impliedly includes authority to own and hold such real estate as is reasonably necessary in conducting its general business. The company is, therefore, empowered to own and hold the surface of land in order to mine coal underneath, and may utilize the surface for agricultural purposes, as an incident of ownership, subject to the right of the state to compel the corporation to dispose of any land not held or used for corporate purposes. One who has wrongfully injured the land by overflowing it cannot assert that ownership of the property was beyond the power of the company, for the purpose of avoiding liability for the damage done. (Illinois Supreme Court, La Salle County Carbon Coal Co. vs. Sanitary District of Chicago, 103 Northeastern Reporter, 175.)

Operation of Illinois Mines Act.—The Illinois mines and miners act requires coal operators to maintain competent shaftsmen at the bottom of each shaft to preserve order and to enforce regulations governing the carriage of men on cages and to keep the shaft lighted. Held, that in a suit by a miner for personal injury, based on his employer's violation of this statute, it is no defense that the miner was guilty of negligence contributing to the accident, or that negligence of a third person concurred to produce the injury, but it must appear that the employer's violation of the law was a direct cause of the accident. A miner does not become a trespasser, so as to lose the benefit of the statute, by entering a shaft before he is required to do so in the performance of his duties, if he enters at a time when a shaftsman should be on duty. Since the purpose of the law is to protect all coal miners, the operator owes the same duty to a miner employed on a night shift, who does not go to work until after the day shift has left and the coal has been hoisted, as is owed to day workers. (Illinois Supreme Court, Brunnworth vs. Kerens-Donnewald Coal Co., 103 Northeastern Reporter, 178.)

*Attorney-at-law, St. Paul, Minn.

SOCIOLOGICAL DEPARTMENT

An Illinois First-Aid Meet

SYNOPSIS—A rescue meet in which the labor union joins with a coal company in offering prizes and directing the events.

The Superior Coal Co., of Gillespie, Ill., has three of the largest coal mines in the state. The No. 3 mine has a record of 4748 tons hoisted in an 8-hr. shift and the 3 mines often produce 12,000 tons in one day.

The Superior mines are officered wholly by progressive young men and are with the leaders in any work which will make coal mining safer and more efficient. From the beginning of the safety movement they have been warm advocates and supporters of the mine-rescue and first-aid development.

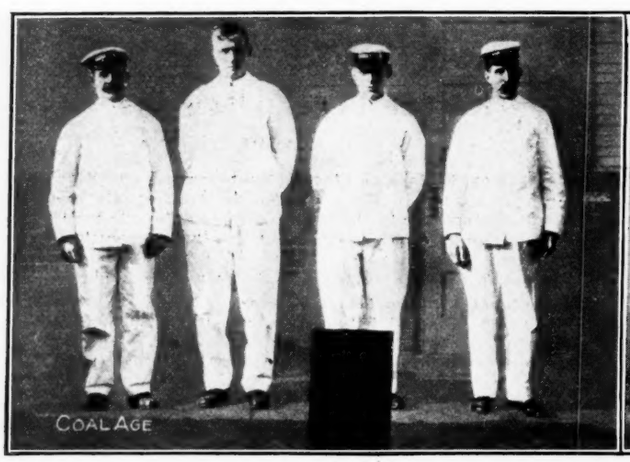
A room has been fitted at the general offices, with Draeger and Fluess rescue helmets and first-aid and mine-rescue equipment. A pulmotor with charged oxygen cylinder is always ready for use in the mines or in the town. Last fall the first of a series of annual field days was held in Gillespie and the Superior Coal Co. presented a beautiful trophy as first prize.

The company is a subsidiary of the Chicago & Northwestern Ry. Co., its mines being located on the Southern Illinois division of that road which has just been completed. On Nov. 18, 1913, President W. A. Gardner, of that railway, who is also president of the Superior Coal Co., made an inspection of the new division and, as he had always been interested in the first-aid movement, it was decided to demonstrate to him and the directors what progress had been made, and an exhibition was given despite the fact that the annual meet was approaching, being scheduled for Dec. 9.

The Mine-Rescue Exhibition

The exhibition was furnished by the first-aid team (Champion No. 1) of the Superior Coal Co., which won the trophy presented by that corporation at the State Fair, on Oct. 10, 1913. It consists of miners from mines Nos. 1 and 2. All the members hold Red Cross certificates. The captain is J. Weir, his subordinates being J. Struthers, C. Miller, J. Couden and W. Wood.

The rescue team was headed by John K. Fraser, assistant mine manager at No. 2 mine who was a captain of one of the rescue teams at the Cherry disaster. The other members were W. Lyons, assistant mine manager at No. 1 mine, J. McMillen, assistant mine manager at No. 3, D. D. Wilcox, assistant chief engineer, and A. W. Carroll, mining engineer at No. 2.



Winners of Superior Coal Co.'s Loving Cup

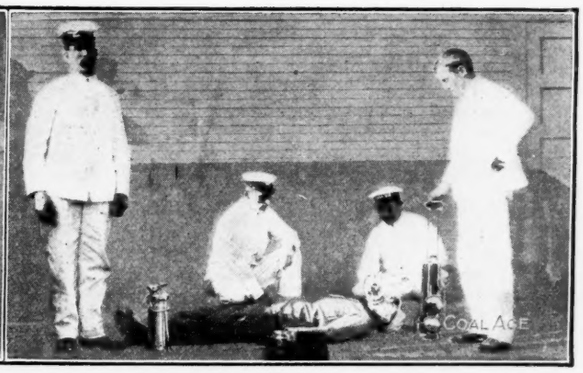
First-Aid Team, Saline Coal Co., Harrisburg, Ill.

The drawing shows the transformation whereby the carpenter shop at No. 3 mine was made to look like a room off an entry. It was assumed that an explosion had taken place in the mine. As soon as it occurred, the rescue squad was called to the office and was met by Assistant Superintendent Shanahan, who as mine manager told the squad what had happened. On arriving at the mine, they were told that checks 301 and 302 were still on the board and that Jones and Smith were, therefore, still below. The helmets were examined and put on immediately and the squad in charge of John Fraser, the captain, started into the mine.

The men carried Wolf and electric safety lamps and made tests for gas as they proceeded. The room was filled with smoke (sulphur and formaldehyde being used to produce the required effect) and a man, a dummy, was found at the point marked on the drawing. The dummy was carried out and on reaching the surface, the first-aid men received the body and substituting a live person performed resuscitatory work on him with the pulmotor with the help of J. Boston, safety inspector.

The rescue teams then reëntered the mine in search of Smith and found his cap and lamp near a fall of slate.

THE GILLESPIE PIPERS, COMPOSED OF MINERS WORKING IN THE SUPERIOR COAL CO.'S MINES



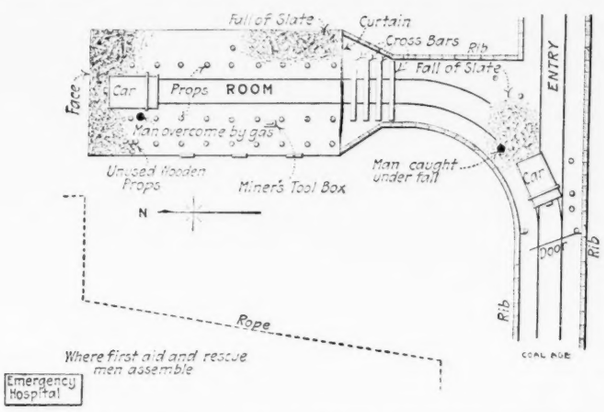
CUBA TEAM USING THE LUNGMOTOR FOR RESUSCITATION WITHOUT AN OXYGEN CYLINDER

A messenger was sent out to get the first-aid men and ventilation being reëstablished they entered the room and removed the patient on a stretcher, the rescue men meanwhile having lifted the slate fall from his prostrate body.

The victim was treated for the following injuries: a scalp wound, lacerated left shoulder, compound fracture of the right forearm, fractured right leg and shock sufficient to render him unconscious.

THE FIRST-AID CONTEST

A first-aid contest was held on Dec. 9, in the Colonial theater in Gillespie, and four towns were represented in the competition, namely, Cuba, Breeze, Harrisburg and Gillespie. The contests opened at 9 a.m. with music on the main street by the local band. D. D. Wilcox, assistant mining engineer of the Superior Coal Co., acted as chairman and called the convention to order.



RESCUE GALLERY AT NO. 3 MINE, SUPERIOR COAL CO.

John Ross, superintendent of the Superior Coal Co., addressed the meeting and expressed his regrets that General Superintendent John P. Reese could not be present as he had been obliged to go to Iowa to attend an important meeting of the operators of that state held to consider the new contract with the miners to be made Apr. 1, 1914.

ALL LOCAL AUTHORITIES REPRESENTED

The Methodist preacher, Rev. Spragg, Frank Hoehn, the superintendent of the Gillespie schools, James Taylor, the state mine inspector and Thomas Downie, president of local No. 730, were the speakers. The reader will do well to examine this list of speech-makers because only by combining all the forces mentioned can a successful campaign for safety be commenced. Mr. Downie explained that the local of which he was president appreciated the movement and had donated money to its support.

The Superior Coal Co. has always realized that success in first-aid work depends on the interest that the employees take in their efforts and the officials understand that the utmost they can do is to encourage and assist, for the real execution lies with the miner himself.

The judges in the contest were A. F. Knoefel, surgeon for the Vandalia Coal Co. and first vice-president of the American Mine Safety Association, Dr. George A. Clotfelter, of Hillsboro, and Dr. Hopkins, of Chicago, chief surgeon of the Chicago & Northwestern Ry.

THE EVENTS

The first problem in the first-aid contest was a one-man event in which 6 men competed.

Two men are entering a mine on an electric locomotive. The trolley wire is down and knocks the trip rider from the motor. The accident happens at a dip where the water has been allowed to accumulate. The trip rider falls under the motor sustaining a fractured thigh and a cut in the groin. The wire when it fell on him gave him a severe shock.

Fullerton Fulton, of Gillespie, received first prize, Bert Peeck, of Harrisburg, second, and Thomas Trigg, of Cuba, third.

In the afternoon, the Gillespie Pipe Band gave a selection after which nine teams competed in the following two-man event:

Two men cutting coal in a room fail to set a prop close to the face. One who is shoveling slack is caught by a fall of slate and coal. The driver comes by and the uninjured man calls on him for assistance. The nature of the injury sustained is a compound fracture of both bones of the left leg just above the ankle, calf badly lacerated, severe hemorrhage, right ear also badly lacerated and an incised wound on left temple.

James Struthers and James Weir, of Gillespie, won first prize and Charles Miller and John Cowden of same place took second.

OSCAR CARTLIDGE AND THOMAS ENGLISH

The next contest was a full-team event.

There has been an explosion in a mine and a driver has been injured in the following manner: Fracture of left arm and elbow, fracture on right side of chest, including seventh, eighth and ninth ribs, fracture of pelvis at middle line in front. Patient unconscious. Adopt the proper treatment and carry the patient 20 ft. on a stretcher.

There were five teams competing. The Cuba team took first prize, Gillespie team No. 2 second prize and Breeze No. 4 third prize.

THE AWARDS

The following prizes were awarded for the team contest:

First Prize—Superior Coal Co.'s trophy for one year with names of contestants engraved. $25 cash donated by Local Union No. 730, U. M. W. of A. An American Mine Safety medal, Red Cross medal and a book entitled "Questions and Answers" were given to each participant, the latter being presented by James Taylor, state mine inspector.

Second Prize—$15 cash. A solid gold medal was presented by the Superior Coal Co., and a book on "Questions and Answers" was donated by James Taylor to each participant.

Third Prize—$10 cash. Solid silver medal presented to each participant by Superior Coal Co.

The prizes for the one-man event were as follows:

First Prize—Trophy awarded by the Superior Coal Co. $10 cash awarded by Local Union 730, U. M. W. of A. American Red Cross medal and American Safety Association medal.

Second Prize—$5 cash and a solid gold medal presented by the Superior Coal Co.

Third Prize—$3 cash and a solid silver medal presented by the Superior Coal Co.

The prizes for the two-man event were:

First Prize—One 17-jewel Waltham gold watch presented by the Superior Coal Co.'s officials to each participant.

Second Prize—One solid gold ring to each participant, given by the officials of the Superior Coal Co.

Among the visitors were Oscar Cartlidge, manager of the state rescue stations; Dave Reese, Superintendent of No. 1 mine of the Peabody Coal Co., of Kinkead, Ill.; Harm Young, district superintendent of Peabody mines, Taylorville, Ill.; Thomas English, superintendent of rescue station, Springfield, Ill., and R. Y. Williams, engineer in rescue department, Bureau of Mines.

The meeting was under the auspices of Local 730 of the United Mine Workers' Union, the American Mine Safety Association and the Superior Coal Company.

Electric Installations in Gaseous Mines

BY DR. ALFRED GRADENWITZ*

Electricity can be used in fiery mines with complete success, provided the mine owner works hand-in-hand with the electrical engineer.

Two fundamental systems have been followed in this connection; the one is based on the principle of installing the electric motor and apparatus at such points in a fiery mine as are free from firedamp, while the other consists of developing motors and apparatus of explosion-proof design, which can be safely employed where there is real danger. Mine owners generally have been in favor of the former system, and, as far as the practice in Europe is concerned, an Austrian plant can be mentioned as a striking instance, namely, the large pumping motors installed in the fiery mines of the Karwin district, where the pump chamber, and not the motor, is protected against the entrance of firedamp. Here it was believed that the explosion-proof enclosure of large motors, such as are necessary for driving central pumping plants, was practically impossible, or, at all events inadvisable at the present state of electrical engineering.

The pump chamber, in this case, was made air tight at the water hole while the connection with the crosscut is provided with three iron doors, the two outer ones opening in one direction, while the inner one opens in the opposite direction.

In addition to electrically driven pumping plants, traction by electric locomotive is also gaining considerably in importance year by year. Two types of locomotives may be used in this connection, one a type for parts free from firedamp, and the other a type for those sections where there is danger. In the first case, locomotives with bare contact wires have been used successfully, while for the second, explosion-proof accumulator locomotives have found favor.

Of the electrically driven machinery in the mines, the hoisting winches are of special importance, as they are generally situated at the highest point in the workings and therefore in greater danger from the collection of firedamp than other machinery. The hoisting engines have therefore been placed in a current of fresh air.

Experiments made in the Gelsenkirchen-Bismark Experimental Station, with a view to the development of explosion-proof motors and apparatus have shown three forms of construction to be possible: First, total inclosure; second, laminated-plate safety-protection; third, oil protection.

The totally inclosed form assumes an explosion-proof construction from the outset and calls for such a casing of motors and apparatus as to be able to withstand the pressure of explosion in the event of any firedamp igniting in its interior.

In the laminated-plate safety-protection, the familiar principle of a Davy lamp is followed, ignition being prevented by a wire gauze which causes the gases to give up their heat as they pass through. The characteristic element of such apparatus takes the form of the packing of laminated plates fixed to the end openings of electric motors or the covers of the inclosed apparatus.

Oil protection is the third form of explosion-proof construction and is employed for motors, as a rule, solely for the protection of the slip ring. Its use enables an extremely convenient form of controlling switch and other apparatus to be adopted. Here the protection against explosion is secured by allowing the opening and closing of any live contacts to take place under oil.

Experiments made by Beyling on motors and apparatus in fiery mines have shown the necessity of testing the operation of the safety devices. The plate protection must be most carefully manufactured, its effectiveness being completely destroyed by a single fault and the same is true of the totally inclosed type, as danger exists where there are any flaws in the casing.

The testing floor erected by the Allgemeine Elektrizitäts Gesellschaft, of Berlin, for testing motors and apparatus to be used in firedamp mines consists of a cement chamber sunk below the level of the ground, which can be subdivided into a number of small compartments and is closed at the top by a paper cover which is torn when the explosion passes from the motor into the chamber. The compartment can be filled with an explosive mixture containing approximately 15 per cent of illuminating gas which, being agitated by an air pump, insures an explosive mixture in apparatus and chamber.

*Berlin, Germany.

DISCUSSION BY READERS

Education and Training of Mining Men

Letter No. 6—It has been suggested by a recent writer, in these columns, that boys should be taken into the mines at an early age in order that they may learn the practical side of mining. While I have the greatest respect for the practical man and honor the man who has risen from the bottom to a position of responsibility, I nevertheless feel that experience should not be gained at the expense of something more valuable; and, on this account, I want to point out a few objections to the course suggested by Mr. Smith, COAL AGE, Nov. 15, p. 743.

First, it must be admitted by all that the moral atmosphere of the mine or that of the average industry is not conducive to the good habits and training of young men. The boy put to work at an early age in the mine is thrown into contact with men of all classes and nationalities. While learning how to put up a brattice, drive a mule and many other things of a practical nature, he picks up at the same time much perverted information on matters that should be taught him only by his parents or teachers. In addition to this, he gets first-hand information on drinking and gambling, by being forced to listen to the discussion of these subjects by devotees. While there are many men who neither drink nor gamble, and others who will refrain from discussing such subjects or repeating immoral stories when a boy is present, their influence, which is largely negative, is more than offset by the conduct of other men who are indifferent to the welfare of the boys and who take a certain delight in instilling evil into the youthful mind.

The man who is down and out presents a certain picturesqueness that appeals to the boyish mind. One such man will often exert a greater influence than a half-dozen men of correct habits. It frequently happens that the boy who has had the advantage of a good home most readily succumbs to these evil influences because of their novelty. If, then, the boy is to become morally strong and a good citizen, keep him from these influences as long as possible or, at least, until his character is formed.

Second, the boy in the mine is surrounded by bodily dangers that he does not fully appreciate. He does not realize the need of caution but learns to take chances. It is convenient for a boss to send a boy on an errand or with a message to another part of the mine, which exposes him to the dangers of moving cars, contact with live wires, falling roof in places with which he is not acquainted, etc. Also, after the first few days in the mine, the inquisitive mind of the boy leads him to investigate the nature and possibilities of live wires, explosives, etc., which may and often does lead to grave results.

Third, the early practical training of the boy means a corresponding neglect of his education or schooling. Too much cannot be said of the value in after life of a good education. I believe every boy should have the advantage of early schooling, wherever this is possible. Early schooling has at least two recognized features: The culture of the mind, and the application of knowledge to industry. Both are equally important. The miner with no early schooling, when dissatisfied with conditions, finds himself generally helpless to alter them and, under improved conditions, he is often incapable of availing himself of the advantage they afford. His untrained mind does not suggest to him the remedy to apply when he is conscious that something is wrong. The fault lies in the lack of early education, for which he or his parents are generally to blame.

The increase of interest in night schools and correspondence study at home is a silent witness to the need that is felt by the man whose early schooling has been neglected. In view of these facts, I would say: Educate the boy first and let him get his practical training later. It will make him a more intelligent and practical man and a more efficient worker.

Fourth, to start life at the practical end commits the boy to a class of work for which he may not be adapted and in which, therefore, he will never succeed. It gives him no opportunity to choose his vocation in life. He has little chance of advancement, little satisfaction in his work, and becomes easily discouraged. His early training does not make it easy for him to change to another calling. It often happens that ill health will compel a man to quit work in the mine; and, in that case, if he lacks useful knowledge that would enable him to take up other work with promise of success, he is helpless and becomes a vagrant.

I have in mind such a case where a miner, unable to work underground, took up the occupation of steel construction and rose to a position of trust. Another alternative is the field of photography. But, on the other hand, the man who went to work in the mine at an early age, though possibly having a natural adaptation for other work, has little chance later of success, owing to the lack of early schooling that is necessary in all advanced callings. Therefore, give the boy the best early schooling you can and thus afford him a chance to make his own choice of a vocation in life.

GEO. N. LANTZ.

New Straitsville, Ohio.

The Certificate Law

Letter No. 7—My experience as a miner who has worked in eight different states in this country and in two shires of Scotland, and has served as mine foreman in three states during the past 15 years, leads me to declare in favor of a *universal* certificate of competency for mine foreman. The work of mining coal and transporting it to the tipple, in respect to safety and economy of operation, requires about the same skill, care and experience on the part of the mine foreman, in whatever state or district the mine may be located. The man who shows the greatest fitness and capacity for the position is generally the one who is most successful, as operators have not much use for incompetent men.

In my opinion, the ambitious mine foreman who holds a certificate in one state and who desires to make a change, should not be barred from holding a similar position in another state. I cannot see that a universal certificate entitling the holder to fill a position as mine foreman in any state will jeopardize lives or property, as this would depend on the competency of the man. On the other hand, such a law would broaden the field of competition and encourage ambitious miners to qualify and fit themselves for positions of trust and responsibility. I believe the law should, likewise, be extended to cover the certificates for fireboss and hoisting engineers so that they could operate in a wider field.

In the practical application of this plan, I would suggest that examining boards, when preparing the questions for examination and granting certificates of competency, should treat the subject in its broadest aspect, so as to cover the different conditions that are liable to occur in mining coal. The inclination or pitch of coal seams varies from zero to 90 deg., so that the seam may lie at any inclination from flat to perpendicular, requiring the adoption of different methods for the extraction of the coal. The possible presence of gas will require a knowledge of how it may be safely removed. It is true the laws are different in the several mining states; but these are in printed form, and a man must acquaint himself thoroughly with the mining laws of the state in which he desires to hold a position as mine foreman.

R. J. PICKETT.

Shelburn, Ind.

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Letter No. 8—I have been much interested in the discussion of the question relating to a uniform mine-foreman certificate law. I notice that some correspondents, in discussing this question, hold that a mine foreman in one state should be considered as being qualified to hold the same position in another state; while others claim that it is better for each state to conduct its own examinations and not to consider the certificate issued by an examining board in another state.

I would like to ask: Cannot this question be compromised and a common ground be determined that would overcome the objections that have been raised? Our mines, at present, are mostly classified as "gaseous" and "nongaseous" mines. We are told the attempt is being made in West Virginia to classify mines as "nonhazardous," "hazardous" and "extra hazardous." Is it not possible to carry out this idea of classification in respect to the certificate law, and group the mines throughout the coal-producing states into two or more classes? The certificates of competency for mine foremen could then be graded to suit these different classes of mines. With suitably organized and authorized examining boards, it would not seem to be difficult to regard a mine foreman certified as competent in one state, to be qualified for holding the same position in another state.

It seems to me that this arrangement would remove the difficulty to which Mr. Wilson refers, COAL AGE, Nov. 8, p. 710, where mines located along the boundary between two states were operated under the mining laws of their respective states; and a mine foreman in charge of a mine on one side of the boundary line could not hold the same position in an adjoining mine on the opposite side of that boundary, notwithstanding the conditions in these two mines were precisely identical.

Although the situation may prove, as in this case, somewhat annoying, it must be allowed that the law is a safeguard against inefficiency. I believe that if the suggestion is worth while, there should be some classification of mines determined upon and some standardization of examinations made that would enable the certified foreman in one state to stand as qualified for holding the same position in the same class of mines in another state.

GEO. N. LANTZ.

New Straitsville, Ohio.

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Analyzing the Mine Cost Sheet

Letter No. 1—Reading the article on this subject by J. B. de Hart, COAL AGE, Dec. 6, p. 842, calls to mind how often it has occurred in my own experience, as well as that of others, that I have tried hard to reason with a mine superintendent how the output of coal could be increased very materially and the cost per ton reduced, by making certain changes that were almost insignificant of themselves. I can endorse every statement in that article as true.

At a mine of which I had charge, some time ago, the main-haulage rope on the slope was breaking twice and sometimes three times a day. I argued with the mine superintendent to show him that the time spent in splicing the rope, together with the loss in output, greatly increased the cost per ton of coal loaded and that this would be saved by getting a new rope, which would soon pay for itself by avoiding these accidents. It was often necessary, in this mine, to stay at night and pay men extra time to hunt old rope and have it hauled out from the workings, to replace sections of the main rope where it was ready to break. It might happen, then, that things would run smoothly the following day and nothing would be said.

It is easy to see that the superintendent, in this case, was not a practical man, which is often the case where a man is taken out of a store and placed in charge of a mine to conduct its operation. Perhaps he has never worked a day inside of a mine, and it is very hard to make him understand that it is necessary to do a great many things in order to systematize the work and reduce the cost, in the mine.

Where haulage was done by an electric motor, it has frequently happened that a bad piece of road would greatly delay the work, because cars were continually getting off the track at certain points. This would tie up the road until the cars could be again put on the track. A little grading of the roads would have overcome this difficulty and reduced the cost by increasing the output. The superintendent promised, time after time, to let me grade the road, after I had explained to him that this could be done without decreasing the output. But he always seemed unwilling to have me go ahead with the grading. There were places where, owing to depressions in the road, the cars would bump together, throwing much of the coal off, which frequently caused wrecks that tore up the track. Besides this causing much delay, it was necessary to put on a night shift to clean the road, all of which could be avoided with a little expense of time and labor to put the track in good condition; but the reply was always: "We cannot stand the expense at the present time."

The suggestion is made that a mine foreman who is trying in every way possible to reduce the cost of putting the coal on the surface, should be encouraged and given full credit for what he accomplishes. But, instead of this, in most cases, a mine foreman who dares to insinuate that the conditions under which he is working are unnecessarily increasing the cost per ton will soon be given to understand that, if the place does not suit him, he can leave. I have known this to happen in more cases than one. I am happy to say that the company by which I am at present employed is making every effort to show the foreman where and how the cost per ton can be reduced. That is what counts in a coal mine. We are continually told to keep our roads well graded, so that the coal can be hauled with as little trouble and delay as possible.

Our general superintendent goes inside the mine each week himself, to see that everything is done. He is always ready to give full instructions and explanation of what is not understood; and suggestions of a foreman are not turned down, but are heard and carefully considered. The foreman is instructed to see that the bituminous-mine law is fully enforced, in every point pertaining to the welfare of the men. Such an interest on the part of a superintendent makes the work run more smoothly and goes far toward reducing the cost per ton. A lack of harmony between the superintendent and his foreman is bound to increase the cost of operation.

JOHN J. CLARK,
Assistant Mine Supt.,
B. & S. Coal & Coke Co.

Sagamore, Penn.

Letter No. 2—It was with much interest I read the foreword, COAL AGE, Nov. 15, and the article along the same line by J. B. de Hart, Dec. 6, p. 842. As I view this question, there is only one obstacle to overcome, in acting upon your suggestion in the second paragraph of the foreword, and that is, the big word "if." Do we "recognize the camp?" It has been my experience, as it has probably been that of others, to be refused the "$600 to build a bathhouse." The reason given for the refusal is that the proposition is more "a matter of sentiment than one of practical business."

In the case to which I refer, the matter was put up to the company with the argument that it would mean a larger labor force; and a larger labor force would mean an increased tonnage, with a reduction in the cost of production. The reply given, however, was to the effect that "neighboring mines did not have a bathhouse." It was argued that the expectation of an increase in labor force was "pure assumption and quite problematic." Should the argument be pressed further, the manager would usually be told that he might build a bathhouse when he had put the mine on a paying basis.

Upon the receipt of this answer, the feelings of the average mine manager are similar to those of the man who tried to purchase a sawmill on credit. On being told that he would have to put up the price before he could be given possession of the mill, he replied that he had not the price and if he had he would not want the mill. If a manager can put the mine on a paying basis without the bathhouse, there is no real need, from a business standpoint, of building one.

This applies to small companies more than to large ones. The manager of a small coal-mining company, today, has before him a herculean task. If he fails to put the mine on a paying basis, it is more often due to a short-sighted policy on the part of the company, rather than to any mismanagement on the part of the one in charge. But the manager is the one who must shoulder the burden and take the blame.

It is surprising to note the number of companies that are in just the condition described in your foreword. It requires more of a hypnotist than a manager, in most cases, to make the company see the need of a practical and reasonable proposition as it appeals to him. He studies the question daily from a practical standpoint; he is the man who must make good and produce results. He feels the need more than anyone else of a broad-gage, far-sighted business policy.

I have in mind an instance of this. Not long ago, a proposition was put up to me by a company and I was asked to suggest a way to make it pay. The president of the company wanted to know if I did not believe it would be a wise plan to do away with the power plant and haul all of the coal from the mine with mules. He suggested, also, shooting the coal from the solid and doing away with mining machines. He, further, wanted to replace the fan with a ventilating furnace. His principal argument, in favor of this plan, was that he had been connected with several operations where there was no power plant and the mine was worked at a profit. Without any further analysis of the situation and without making any attempt to ascertain the true reasons why these mines were run at a profit, while the one of which we had charge appeared to be a losing proposition, he concluded blindly that the uptodate equipment of this mine was a needless expenditure of capital, which could be put to better use.

After listening patiently to his suggestions, I attempted to show him that the real trouble, in the present case, was that some of the machinery was out of repair and must be put in good condition to do the efficient work of which it was capable. I argued that if this was done, it would not be long before the mine would be operated on a paying basis and prove a profitable investment. He failed to see the wisdom of this advice; and it seemed impossible to convince him that a comparatively slight additional outlay for needed repairs was all that was required to produce good results and put the coal on the track at a profit.

While this is but one incident among a hundred others, it illustrates the policy of a large number of companies who are mining coal, today, at a small profit and too often at a loss. Imagine, for a moment, the manager of such a company asking for $600 with which to build a washhouse. He might as well ask, at the same time, to be relieved of his duties as manager. The case is almost hopeless under these conditions, and, as I said before, the manager for such a company has on his hands a herculean task. In this connection, I thoroughly endorse the excellent article of Mr. de Hart on Analyzing the Mine Cost Sheet. The article is opportune and should appeal forcibly to every coal-mining company. I have not written this in criticism so much as to point a way to remedy the difficulty and assist the mine manager and foreman in their honest endeavors to produce results.

G. M. SHOEMAKER.

Pennington Gap.

Technical Education in Mining

The foreword, COAL AGE, Nov. 1, after setting forth the desirability of having a technically educated man in the position of mine manager, proceeds to compare this man unfavorably with the so called practical man. This seems a little illogical, if not unfair. If it were assumed that competent engineers attack problems in mining, in the manner described, the question might justly be asked: What use are engineers in any organization? What confidence can be placed in an engineer who would consider only "first cost and relative life of mine cars," or, having a knowledge of "fan efficiencies and water-gage readings, neglected to consider the size, length and condition of the airway," in respect to improving the ventilation.

In justice to the engineer, permit me to cite one or two instances where his technical education and training are indispensable? At a certain mine not employing an engineer, a fan is needed and several manufacturers are asked to investigate and submit bids for the same. All reliable manufacturers of mine equipment have capable engineers in their employ; but, as every operator knows, these engineers cannot be expected to make full and careful investigation of the conditions inside the mine, when the chances are only one in ten of their securing the contract for the installation.

Another instance is: A practical manager wanted a tipple profanely quick, and he got it; and, as a result, a very brittle coal is dropped into cars from a height of about 8 ft., producing loss from breakage of coal and causing complaints from consumers. In some cases, tipples are built requiring the coal to be hauled up an incline, where a change of location would permit of a gravity road leading to the tipple.

On the other hand, I know of cases where engineers were called into consultation, in the matter of purchase of mine cars and interested themselves in determining the relation between wheel-base and minimum radius of curvature for the tracks; the width of car was decided in accordance with roof conditions. The center of gravity of the load in the cars was kept as near as possible to the floor of the mine.

The suggestion in the foreword, that able men of both classes are of advantage, should not mislead anyone. The man in authority without some technical training is fast passing from the mines; because, with the help of such mining papers as COAL AGE and the assistance of correspondence schools and night schools, a man need not leave his work to obtain a good technical education.

COLORADO ENGINEER.

Trinidad, Colo.

Study Course in Coal Mining

BY J. T. BEARD

The Coal Age Pocket Book

Natural Ventilation In Slope Mines and Dip Workings—The same condition in respect to the natural heat of the mine producing or modifying the circulation of the air, holds in all slope mines and dip workings, the same as in shafts and drifts. Whenever the mine temperature is much below or above that of the outside atmosphere, the difference in temperature makes the return air heavier or lighter than the intake air; and the difference in weight of these two air columns destroys the equilibrium of the mine air and creates a current in the airways throughout the mine.

A considerable difference of temperature is often observed between the dip and rise air currents in particular sections of a mine. It is this difference in the temperatures of the intake and return currents that often makes dip workings harder to ventilate in summer than in winter. For the same reason, rise workings are frequently found to be more easily ventilated in the summer season.

Air Columns—The term "air column," like water column, always refers to a vertical column. The air column, in ventilation, is an imaginary vertical column of air, of unit section (commonly, 1 sq.ft.) and of such height that its weight, in pounds, is equal to the pressure it measures (lb. per sq.ft.). The density of the air (wt. per cu.ft.) is either stated or understood, so that when the height of air column is given the pressure it indicates is readily calculated.

In mining practice, it is common to express ventilating pressure in feet of air column or, as we say, "head of air." Calling the weight of 1 cu.ft. of air w (lb.) and the head of air column h (ft.), the pressure p (lb. per sq.ft.) is calculated by the formula

$$p = w h$$

Or the air column corresponding to any given pressure is found by transposing this formula; thus,

$$h = \frac{p}{w}$$

Example—What is the head of air column corresponding to a ventilating pressure of 10 lb. per sq.ft., assuming a temperature of 60 deg. F. and a barometric pressure of 30 in.?

Solution—The weight of 1 cu.ft. of air, at the given temperature and pressure is

$$w = \frac{1.3273\,B}{460 + t} = \frac{1.3273 \times 30}{460 + 60} = 0.0766\ lb.,\ nearly$$

The required head of air is then

$$h = \frac{p}{w} = \frac{10}{0.0766} = 130.5\ ft.$$

Example—Find the ventilating pressure and water gage corresponding to 80 ft. of air column, at the same density.

Solution—

$$p = w h = 0.0766 \times 80 = 6.128\ lb.\ per\ sq.ft.$$

$$w.g. = 6.128 \div 5.2 = 1.18\ in.,\ nearly$$

The Coal Age Pocket Book

Air Column and Water Gage—Since water is practically 815 times as heavy as air at normal temperature and pressure, 1 ft. of water column measures the same pressure as 815 ft. of ordinary air column; and 1 in. of water gage is therefore equal to 815 ÷ 12 = say 68 ft. of air column, which gives the following:

Rule—To reduce feet of air column to inches of water gage, divide by 68.

To reduce inches of water gage to feet of air column, multiply by 68.

Air Column and Unit Ventilating Pressure—Since air at a normal temperature and pressure weighs, practically, 13 cu.ft. to the pound, every 13 ft. of air column represents, approximately, a ventilating pressure of 1 lb. per sq.ft., which gives the following:

Rule—To reduce feet of air column to unit pressure, divide by 13.

To reduce unit pressure (lb. per sq.ft.) to feet of air column, multiply by 13.

Air Column and Barometric Pressure—Since 1 cu.in. of mercury weighs 0.491 lb., each inch of mercury column indicates a pressure of 0.491 lb. per sq.in.; or 0.491 × 144 = 70.7 lb. per sq.ft.; and since each pound per square foot of pressure corresponds to 13 ft. of air column, approximately,

$$1\ in.\ (barometer) = 70.7 \times 13 = say\ 920\ ft.\ (air\ column)$$

Rule (Approximate)—To reduce feet of air column to inches of barometer, divide by 920.

To reduce barometric pressure (inches) to feet of air column, multiply by 920.

Barometric and Unit Ventilating Pressure—Barometric pressure is always expressed in inches of mercury column. Unit ventilating pressure is expressed in pounds per square foot, ounces per square inch, or inches of water gage.

Rule—To reduce barometric pressure (inches) to ventilating pressure (lb. per sq.ft.), multiply by 70.7; or to ventilating pressure (oz. per sq.in.), multiply by 0.491 × 16 = 7.856; or to water gage (in.), multiply by 70.7 ÷ 5.2 = 13.6, which is the specific gravity of mercury referred to water as a standard.

Since 13 ft. air column represents a pressure of 1 lb. per sq.ft., a pressure of 1 oz. per sq.in. corresponds to an air column of (13 × 144) ÷ 16 = 117 ft.

EQUIVALENTS IN PRESSURE

Air column (ft.)	=	68 ×	water gage (in.);
	=	13 ×	pressure (lb. per sq.ft.);
	=	117 ×	pressure (oz. per sq.in.);
	=	920 ×	barometric pressure (in.);
Pressure (lb. per sq.ft.)	=	5.2 ×	water gage (in.);
	=	70.7 ×	barometric pressure (in.);
Pressure (oz. per sq.in.)	=	0.58 ×	water gage (in.);
	=	7.86 ×	barometric pressure (in.);
Water gage (in.)	=	13.6 ×	barometric pressure (in.);

INQUIRIES OF GENERAL INTEREST

Electrical Resistance of Steel Rails

We have had an argument about the difference in resistance between a copper wire and steel rails, and desire to submit the question to you, in hopes that you can give us the necessary information. The question is:

What is the difference in resistance between a 4-O round copper wire 3000 ft. long and the two 25-lb. steel rails, in a track, 2000 ft. long, followed by two 30-lb. steel rails, in 1000 ft. of track? The rails are bonded with pressed-terminal all-wire 2-O bonds.

Will you also kindly state how many kilowatt-hours will be available at the end of a 250-volt line, where a 30-hp. motor, 3000 ft. from the generator, is taking 100 amperes?

H. E. BULLOCK.

Hazard, Ky.

The resistance of 1000 ft. of a 4-O copper wire at, say 68° F. (20°C.), as taken from a table giving the resistances of copper wires for different gages and temperatures, in ohms per thousand feet, is 0.04893 ohm. The resistance for such a conductor 3000 ft. long is then, $3 \times 0.04893 = 0.14679$ ohm.

An approximate rule for calculating the resistance of copper wire per thousand feet, in ohms, is to divide 10,000 by the size of the wire in circular mils. Thus, for a 4-O wire (211,600 circ.mils), the resistance is, approximately,

$$R = \frac{10{,}000}{211{,}600} = 0.04726 \text{ ohm per } 1000 \text{ ft.}$$

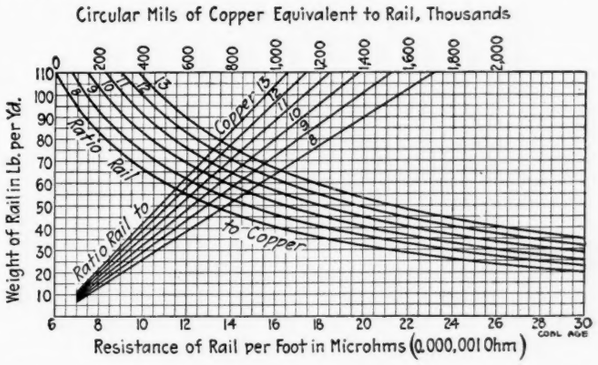
This rule should only be used in rough calculations. When accuracy is desired, the resistance for the wire should be taken from electrical tables, as above stated.

The resistance of steel rails, for the same cross-section and length, varies with the composition of the steel. The presence of sulphur and manganese, particularly the latter, greatly modifies the resistance of the steel. It has been found that this resistance will vary from about eight to thirteen times that of copper of the same sectional area and at the same temperature. This has given rise to what is termed the "ratio of rail to copper" or the "rail-to-copper ratio." The results of numerous experiments have made it possible to calculate the equivalent *circular mils of copper* corresponding to any given weight of rail in pounds per yard, for any rail-to-copper ratio. To do this, the weight of rail, in pounds per yard, is multiplied by the constant corresponding to this ratio, as determined by the composition of the steel. The value of this constant, for the several ratios, is as follows:

Rail-to-Copper Ratio	Constant	Rail-to-Copper Ratio	Constant
8	15,550	11	11,360
9	13,820	12	10,360
10	12,500	13	9,590

Applying this method to the solution of the question asked by correspondent and assuming a rail-to-copper ratio of 10, the constant for this ratio, as taken from the above table, is 12,500. Then, for a 25-lb. rail, the equivalent circular mils of copper is $25 \times 12{,}500 = 312{,}500$. Electrical tables are not generally extended to include as large a wire as this area indicates. The resistance in ohms per thousand feet, however, can be calculated, approximately, by the rule previously given. Thus, $10{,}000 \div 312{,}500 = 0.032$ ohm. The resistance of the two rails, in the first 2000 ft. of this track, is the same as the resistance of a single 25-lb. rail 1000 ft. long, or 0.032 ohm.

Again, for a 30-lb. rail of the same composition, the equivalent circular mils of copper is $30 \times 12{,}500 = 375{,}000$. The corresponding resistance is, therefore, approximately, $10{,}000 \div 375{,}000 = 0.0267$ ohm. The resistance of the two rails, for 1000 ft. of track, is one-half of this amount, or 0.01335 ohm. The total rail resistance in this track is, therefore, $0.032 + 0.01335 = 0.04535$ ohm; and the difference, in favor of the iron rails, is $0.14679 - 0.04535 = 0.10144$ ohm.



DIAGRAMS SHOWING COPPER EQUIVALENT AND ELECTRICAL RESISTANCE OF STEEL RAILS

The above combined diagrams, taken from the Ohio Brass Co.'s catalog, show graphically the circular mils of copper, of equal electrical resistance to steel rails of different weights and "rail-to-copper ratios." The curved lines show the resistance, in microhms, of steel rails of different weights and ratios.

The diameter, in inches, of a copper wire that is the electrical equivalent of a steel rail of a given weight (lb. per yd.) may be calculated by multiplying the respective constant taken from the above table, by the weight of the rail, extracting the square root of the product and dividing that result by 1000. Thus, for a rail-to-copper ratio of 10, the constant is 12,500. Then, the diameter of the copper-wire equivalent is

$$d = \frac{\sqrt{25 \times 12{,}500}}{1000} = 0.559 \text{ in.}$$

In answer to the second question, a 30-hp. motor consumes $30 \times 746 = 22{,}380$ watts or 22.38 kw. If this motor is taking, as stated, 100 amp., the voltage, at the full capacity of the motor, is $22{,}380 \div 100 = 223.8$ volts. The drop in voltage for this line is, therefore, $250 - 223.8 = 26.2$ volts. The work performed by this motor, in each hour, when working at its rated capacity, is 22.38 kw.-hr.

EXAMINATION QUESTIONS

Miscellaneous Questions

(*Answered by Request*)

Ques.—A mine airway is 8 ft. high, 8 ft. wide and 10,000 ft. long; (a) find the rubbing surface. (b) Assuming a unit of resistance, $k = 0.00000002$ and a water gage $w.g. = 2$ in.; what is the velocity of the air current? (c) What is the quantity of air in circulation? (d) What is the horsepower on the air?

Ans.—(a) This airway being square its perimeter is $4 \times 8 = 32$ ft.; the rubbing surface is then $s = 32 \times 10{,}000 = 320{,}000$ *sq.ft.*

(b) The unit pressure corresponding to 2 in. of water gage is $2 \times 5.2 = 10.4$ lb. per sq.ft. The sectional area of this airway is $8 \times 8 = 64$ sq.ft. The velocity of the air current, in this case, is therefore

$$v = \sqrt{\frac{pa}{ks}} = \sqrt{\frac{0.00000002 \times 320{,}000}{10.4 \times 64}}$$

$$= 322.5 \text{ ft. per min.}$$

(c) The quantity of air in circulation is

$$q = a\,v = 64 \times 322.5 = 20{,}640 \text{ cu.ft. per min.}$$

(d) The horsepower on the air is

$$H = \frac{qp}{33{,}000} = \frac{20{,}640 \times 10.4}{33{,}000} = 6.5 \text{ hp.}$$

Ques.—(a) A certain power is producing 20,640 cu.ft. of air per min. in an airway 8x8 ft., at a velocity of 322.5 ft. per min.; what quantity and velocity will the same power produce in an airway 6x6 ft. of the same length?

(b) What horsepower would be required to produce the same quantity of air in this airway as in the previous one and what would be the water gage, in that case?

Ans.—(a) For the same power on the air, the quantity of air in circulation varies directly as the sectional area and inversely as the cube root of the perimeter, the airways being of the same length. Therefore, the quantity ratio is equal to the area ratio times the cube root of the inverse perimeter ratio. The sectional areas and perimeters of the two airways are as follows:

Airway 8x8 ft.,

$a = 8 \times 8 = 64$ *sq.ft.*, $\quad o = 4 \times 8 = 32$ *ft.*

Airway 6x6 ft.,

$a = 6 \times 6 = 36$ *sq.ft.*, $\quad o = 4 \times 6 = 24$ *ft.*

Equating these values as ratios, as stated above,

$$\frac{q_2}{q_1} = \frac{a_2}{a_1}\sqrt[3]{\frac{o_1}{o_2}} = \frac{36}{64}\sqrt[3]{\frac{32}{24}} = \frac{9}{16}\sqrt[3]{\frac{4}{3}} = \frac{9}{16}\sqrt[3]{1.333} = 0.619$$

But, $q_1 = 20{,}640$ cu.ft. per min. and calling the required quantity $q_2 = x$,

$$\frac{x}{20{,}640} = 0.619$$

$x = 20{,}640 \times 0.619 = 12{,}776$, say 12,800 *cu.ft. per min.*

The velocity in the 6x6-ft. airway may be found in two ways. For the same power on the air and the same length of airway, the velocity varies inversely as the cube root of the perimeter of the airway, or the velocity ratio is equal to the cube root of the inverse perimeter ratio; thus,

$$\frac{v_2}{v_1} = \sqrt[3]{\frac{o_1}{o_2}} = \sqrt[3]{\frac{32}{24}} = \sqrt[3]{\frac{4}{3}} = \sqrt[3]{1.333} = 1.1006$$

But $v_1 = 322.5$ ft. and calling the required velocity of air x,

$$\frac{x}{322.5} = 1.1006$$

$$x = 322.5 \times 1.1006 = 355 \text{ ft. per min.}$$

The velocity of the air current can also be found as follows, when the sectional area is known:

$$v = \frac{q}{a} = \frac{12{,}800}{36} = 355 \text{ cu.ft. per min.}$$

(b) To increase the quantity of air in circulation in the 6x6-ft. airway, to that produced in the 8x8-ft. airway, it will be necessary to increase the power. Then, considering the 6x6-ft. airway only, since the power varies as the cube of the quantity of air in circulation, the power ratio is equal to the cube of the quantity ratio. Thus, calling the required power x, the original being 6.5 hp.

$$\frac{x}{6.5} = \left(\frac{20{,}640}{12{,}800}\right)^3 = \left(\frac{129}{80}\right)^3 = (1.6125)^3 = 4.19$$

$$x = 6.5 \times 4.19 = 27.235 \text{ hp.}$$

Since the original water gage was not given for the 6x6-ft. airway, it is necessary to calculate the water gage, in this last case, from the circulation of 20,640 cu.ft. of air by 27.235 hp.; thus,

$$w.g. = \frac{33{,}000\,H}{5.2\,q} = \frac{33{,}000 \times 27.235}{5.2 \times 20{,}640} = 8.37 \text{ in.}$$

Ques.—An airway 8x8 ft., 10,000 ft. long, is passing 20,640 cu.ft. of air per min., with a given power. (a) Assuming the *power* on the air remains unchanged, and a regulator having an opening of 3 sq.ft. is introduced into this airway, how much will the circulation be decreased? (b) Assuming the power on the air remains unchanged, will the regulator increase the water gage? (c) If the original water gage was 2 in., what will be the water-gage reading after the regulator is in place? (d) What water gage and horsepower on the air will be required to increase the circulation to the original amount with the regulator still in place?

Ans.—(a) Calling the original quantity of air in circulation q, the rubbing surface s, and the sectional area a; the area of the opening in the regulator A and the required quantity of air, after the regulator is in place, x, this reduced volume of air may be calculated by the formula

$$x = q\sqrt[3]{\frac{A^2 s}{A^2 s + 41.6\,a^3}}$$

The rubbing surface is $s = 10{,}000\ (4 \times 8) = 320{,}000$ sq.ft. and the sectional area, $a = 8 \times 8 = 64$ sq.ft.

$$x = 20{,}640\sqrt[3]{\frac{3^2 \times 320{,}000}{3^2 \times 320{,}000 + 41.6 \times 64^3}}$$

$$= 12{,}250 \text{ cu.ft. per min.}$$

(*To be concluded next week*)

COAL AND COKE NEWS

Washington, D. C.

In its report submitted to Congress on Dec. 19, the Interstate Commerce Commission reviews the work of the past year with reference to the prosecution of coal companies and rather severely criticizes coal miners for the methods they have been employing in their business. The Commission points out that an indictment has been secured against the Lehigh Valley R.R. Co. for granting a concession by leasing certain lands at Buffalo for a coal yard to the Yates-Lehigh Coal Co. at less than a fair rental. Similarly, an indictment has just been returned against the Wichita Falls & Northwestern R.R. Co. for granting a concession by subletting certain land to an interstate shipper at a lower retal than the carrier was itself paying to the original lessor.

Another indirect device for granting a rebate for which indictment has been secured during the year, says the Commission, is that resorted to by the Vandalia R.R. Co. in favor of the Lumaghi Coal Co. The Vandalia Mineral Co. is a corporation formed by interests controlling the Vandalia R.R. Co. for the purpose of holding coal-mining lands which the Vandalia R.R. Co. under its charter was not permitted to own. The Vandalia Improvement Co. is a holding company also controlled by the interests controlling the Vandalia R.R. Co.

When the Vandalia Mineral Co. was organized the Vandalia Improvement Co. bought all of its stock with money furnished by the Vandalia R.R. Co. Investigation showed that the Vandalia Mineral Co. loaned $260,000 to the Lumaghi Coal Co. to buy coal-mining properties located on the line of the Vandalia R.R. Co. This loan was made at 2 per cent. interest on condition that the Lumaghi Coal Co. would ship all of its coal over the Vandalia R.R.

It further developed that the Vandalia Mineral Co. has borrowed this money from a bank at 4 per cent. interest on notes which had been endorsed by the Vandalia R.R. Co.

Still another case in which carriers are alleged to have connived with a shipper for the purpose of defeating the published rates by roundabout methods was presented to a Federal grand jury in the eastern district of Illinois. The O'Gara Coal Co., a New York corporation, with its principal office in Chicago, had a contract for supplying fuel coal to the Grand Trunk Ry. Co. of Canada. This coal was shipped from the mines in southern Illinois via the Cleveland, Cincinnati, Chicago & St. Louis and Chicago, Indiana & Southern to South Bend, Ind., where it was turned over to the Grand Trunk Western Ry. Co. All of the shipments were billed by the O'Gara Coal Co. to Battle Creek, Mich., a point on the Grand Trunk Western.

As a fact, however, the contract of the O'Gara Coal Co. with the Grand Trunk Ry. Co. provided for delivery of the coal at South Bend, Ind., the junction point between the Chicago, Indiana & Southern Ry. and the Grand Trunk Western. By the arrangement with the Big Four the O'Gara Coal Co. prepaid to this carrier the freight charges to South Bend on the basis of unpublished divisions of the through rates to Battle Creek.

These divisions were less than the local rates to South Bend which should have applied. In this manner the O'Gara Coal Co. secured concessions on all of the coal shipped. The tariffs of the Cleveland, Cincinnati, Chicago & St. Louis expressly prohibited partial prepayment of freight charges when through rates were in effect. In order to make possible the practice of the O'Gara Coal Co. the Cleveland, Cincinnati, Chicago & St. Louis and the Chicago, Indiana & Southern Ry. Co. ignored this tariff provision.

A Fictitious Destination Is Given

Two important prosecutions have been undertaken against carriers for having their company coal billed to fictitious destinations on their line in order to defeat the published rates to actual destinations. Investigations showed that in several hundred cases the Seaboard Air Line Ry. Co. had carloads of coal shipped from Briceville, Tenn., and nearby points on the Southern Ry. billed to the Seaboard Air Line at Williams, Ga.

These shipments were delivered by the Southern Ry. to the Seaboard Air Line at its junction at Helena, Ga. Many of the shipments were consumed at that junction point and others were diverted to other points, but none of them went to Williams, Ga., as the billing directed.

The result was that, instead of paying the local rate of the Southern Ry. Co. from Briceville to Helena or the joint rate from Briceville to destination and receiving out of it jointly its appropriate division the Seaboard Air Line paid the joint rate applying to the more distant point out of which the Southern Ry. received a division much smaller than its local rate to the junction or its division of the joint rate to actual destination.

Other schemes of the same kind are discussed at some length.

The Alaskan Ry. Receives Endorsement

In a report sent to Congress Dec. 24, Secretary of the Interior Lane endorses the plan of a Government railroad in Alaska and urges the opening up of Alaskan coal fields under a leasing and royalty system which he says would make it sufficiently worth while for investors to engage in the exploitation while it would protect the Government. Secretary Lane also says that the same leasing system ought to be applied to Western coal and remarks:

We wish cheap coal and at the same time a minimum of waste. . . . . We desire competition without waste, a frank impossibility. . . . . In a new country where there must be large development and higher rewards for enterprise, the safest practicable method is to lease the land, the Government taking a modest royalty and retaining some measure of control over operation.

PENNSYLVANIA

Anthracite

Pottsville—Plans for the new coal stripping operations at the top of the Broad Mountain are now in progress. This will involve an expenditure of many thousands of dollars, by the Philadelphia & Reading Coal & Iron Co. The surface from Mt. Laffee to Millins Hill is to be cleared away, exposing the valuable coal measures.

It is unofficially stated that within a few days one of the most historic collieries of the anthracite region, East Bear Ridge, near Mahanoy Plane, will pass from the control of the Philadelphia & Reading Coal & Iron Co. to the Susquehanna Coal Co. This mine has been worked since 1830, or over three-quarters of a century.

Hazleton—Anthracite miners are already beginning preparations for the spring of 1916, when the present wage agreement expires. Local No. 1739 of Lansford has adopted a resolution to be offered at the International Convention of the United Mine Workers, in Janury, urging that agitation and organization of unorganized labor in the United States and Canada be continued, in order that in 1916 the mine workers will be in a position to make a general stand, and upon the eve of a great presidential election "make great headway along the line of political and economic action."

Concrete City—Every one of the twenty double houses in Concrete City, the model village of the D. L. & W. Coal Co., near Nanticoke, is now occupied; and with the completion of the park in the big square 300x410 ft., which is surrounded by the houses, the settlement will be as perfect of its kind as Forest Hill, L. I., the model suburb of the Russell Sage Foundation.

Bituminous

Royal—Thieves recently stole $700 in cash from the W. J. Rainey Coal Co., office in the store. The money was in pay envelopes and represented the amount miners has failed to lift the previous day. The theft was not discovered until delinquet miners appeared at the office for their pay.

Pittsburgh—It is said that President Van Bittner has been reëlected president of district No. 5, by at least 6000 majority. F. P. Hanaway is elected vice-president by about the same majority and Robert Wood, secretary-treasurer, while Philip Murray, was reëlected international board member.

WEST VIRGINIA

Fayetteville—Three dwelling houses belonging to the Cannelton Coal Co., at Cannelton, were totally destroyed by fire recently entailing a severe loss. Several other buildings were badly damaged, all being partially insured.

Charleston—An extension of time until Feb. 15 has been given to the English syndicate contemplating the purchase of most of the properties in the New River district. An agreement was reached at a recent conference on the terms of the contract, and the matter is now wholly in the hands of those who are to raise the finances for the transfer of the property.

Wheeling—Following the attack upon Frank Long by four Italians believed to be members of the Italian Mafia society, the arrest of Long's assailants is expected. Mr. Long had been implicated in the mine trouble of Brooks county, and for some time past had heard rumors that he was marked by the Black Hand.

ALABAMA

Birmingham—A petition in involuntary bankruptcy was recently filed against the Oak Leaf Coal Co., of Cordova. The petitioning creditors were: The Hendon Hardware Co., J. A. Williams, Lantrip Bros., and J. P. Higginbottom, all of Cordova.

OHIO

Columbus—A movement has been started among the employers of labor in Ohio in which the coal operators have joined for a number of amendments to the Workmens Compulsory Compensation law which becomes effective Jan. 1, 1914. As the law stands at present hardships are worked on employers and efforts will be made to secure amendments, which will make it less burdensome. A number of bills are now being prepared to be presented at the extraordinary session of the legislature.

Bellaire—Reports which have been in circulation recently that the rail and river mines were to shut down on account of slack orders are false. According to a semi-official statement, if any time has been lost, or is lost in the future, it will be because a sufficient number of cars to handle the output cannot be secured.

INDIANA

Clinton—Miners in the local unions in the Clinton field met here to consider recommendations for the biennial settlement between miners and operators in the central competitive district, which will have its first consideration at a joint meeting in Indianapolis Jan. 6. Both sides are said to be pretty well satisfied with the present agreement and much less difficulty than formerly is expected in reaching a settlement. Indiana operators seem to have prospered the last two years and miners have had comparatively steady work.

Miners at the Lyford mine struck recently because the superintendent asked some of them to wade through wet bottoms to reach their rooms and they demanded the dismissal of the superintendent. The district president censured the men for stampede methods and they went back to work, after the company agreed to keep the entries as dry as possible.

Vincennes—The American Coal Co. has completed two miles of switch from the Knox mine to Aliceville, a new town near Vincennes, started by the establishment of a mining camp by the company. About 300 miners, mainly from Hymera, have moved here and 300 more are expected by next summer.

Brazil—Operators in the block field say they are finding it hard to meet the competition in Chicago, of the unorganized strip mines in and around Patricksburg, in Owen and Green counties. The union operations pay miners $1.15 a ton while the miners in the non-union mines, it is said; get $1 to $2 a day. There are no regulations as to the width of bars or screens and the non-union mine can put a cleaner coal on the market.

ILLINOIS

Marion—At the recent election at Energy, a mining town northwest of here, the women successfully out-voted the miners, and succeeded in piling up a majority against he saloon element.

Springfield—It is understood here that the principal contentions of the miners in their next agreement with the operators will be a raise of wages and a shorter day, or one of seven hours. The present agreement expires next spring.

MISSOURI

Novinger—Miners at Novinger, Mo., were unable to get their pay checks cashed recently, as the result of a fire which destroyed the Union bank. While the safe was fireproof, the casing and breaching became sweated together and bank officials were unable to open it. Mine officers sent to St. Louis for money and paid the miners within 24 hours.

St. Louis—The hearing before Commissioner Harlan of the Interstate Commerce Commission, recently, on behalf of the railroads for an increase of 5½% in coal rates to St. Louis, and also on behalf of several petitioners to abolish the 20c. per ton bridge toll to St. Louis, brought out the fact that the railroads were discriminating to the extent of 10c. per ton against the City of St. Louis, in favor of East St. Louis, Granite City, and Madison.

It also developed the fact that the fight for the removal of the bridge toll was inspired almost altogether by the operators of mines in the Inner District taking the 52c. freight rate to St. Louis. This is an old fight between the operators of the Inner District and the operators of the Outer District, which takes the 67c. freight rate to this city.

The operators in the Inner District want their rate reduced, and want the Commission to raise the rate from the Outer District. It is likely that the Commission will order, as a result of the testimony, the St. Louis Terminal Railway Association to reduce the Bridge Toll of 20c. a ton to 10c. a ton, but that is about as far, competent authority claims, as the Commission will go as a result of the hearings.

NORTH DAKOTA

Medora—The Medora coal mine is again in operation, and the owner claims the only kiln dried lignite in the state. It is estimated by the State Geologist that the mine property will produce 1,400,000 tons.

COLORADO

New Castle—Union miners who recently went on strike here and whose places were taken by the men who met death in the recent coal mine disaster, almost to a man volunteered to enter the mine after the explosion to recover the bodies of the dead. The organization of the United Mine Workers also furnished $300 to be used by the union to relieve the distress of the families of non-unionists.

OREGON

Roseburg—Excitement is still high in the new coalfield 40 miles east of here and many locations are being made. A good grade of coal is found, which experts say is equal to the Pennsylvania product and much better than other coals that have been mined in Oregon.

WASHINGTON

Morton—Nine persons have made application to obtain patents each for 160 acres of coal land near this town. The development of these lands will mean much for this section, as the coal is a high-grade bituminous.

FOREIGN NEWS

Juneau, Alaska—The registrar in the land office has recommended to the commissioner of the general land office that charges against the Willoughby coal claims in the Bering River district, be dismissed. Cancellation was sought on account of the claimant's failure to prove tract as required by law. There have been no allegations of fraud. The area involved is approximately 480 acres, and the owners are Portland, Ore., and Wilkes-Barre, Penn., parties.

Caracas, Venezuela—Despite the large imports of coal, Venezuela exported during the first half of the current year, 40,026 kilos (88,857 lb.) of this fuel. This is accounted for by the fact that Venezuelan wholesalers supply a number of nearby coast towns in Colombia and Brazil.

PERSONALS

E. T. Hendon has been appointed receiver for the Oak Leaf Coal Co., which recently went into bankruptcy.

Judge Ruppel has appointed the following examining board to hold examinations for mine foreman and fire bosses in Somerset County, Penn.: Mine Inspector Fletcher W. Cunningham, Richard Maize, superintendent of the United Coal Co. and Orville Kregar, of Boswell.

Samuel B. Eaton, for many years general superintendent of the coal mining properties of Crear, Clinch & Co., near Duquoin, Illinois, has resigned. Mr. Eaton has recently disposed of his interest in the company, and will probably move to California. He is succeeded by E. C. Searls.

F. S. Peabody, president of the Peabody Coal Co., and chairman of the Executive Board of the Commonwealth Edison Co., recently delivered an illustrated lecture upon the subject of coal and coal mining before 500 employees of the Commonwealth Edison Co., in the Sherman House at Chicago.

George P. Gallagher, District Superintendent of Exeter, Westmoreland and Maltby Collieries of the Lehigh Valley Coal Co., has been promoted to the position of Assistant Division Superintendent of the Lackawanna Division, to succeed G. P. Troutman, who has resigned to become Assistant General Manager for Markle & Co.

J. E. Baumgartner who has been for the past five years General Superintendent of eleven mines owned by the Superior Coal Co., of Wellston, Ohio, has resigned his position, to take place after the first of the year. Mr. Baumgartner is one of the youngest superintendents in the state and has worked his way up from a trapper boy. He is undecided as to the future.

James Taylor, who was appointed State Mine Inspector of Illinois in 1887, by Governor Dick Oglesby, and who has served ever since with the exception of the Altgeld administration, tendered his resignation to Governor Dunne on Nov. 10. In reply the governor said. "Kindly continue to perform the duties of your office until further notice." It appears that the governor is in no hurry to displace an efficient man in a position where much depends upon experience and ability.

OBITUARY

Daniel M. Barton, general purchasing agent of the General Electric Co., died at his home in Schenectady recently after an illness of five days.

Mr. Barton was born in Moriah, N. Y., in 1843, removing with his parents to Massachusetts while still a child. In 1893 he became assistant purchasing agent of the General Electric Co. and a few years after the main office of this firm was established in Schenectady, he became general purchasing agent, which position he ably filled until the time of his death. He is survived by a wife, a daughter, three grandchildren, a brother and a sister.

RECENT COAL AND COKE PATENTS

Coal Cutting Machine. A. Scharf, 2 Westerbleichstrasse, Dortmund, Germany, 9448 of 1913.

Improvements in Coal Cutting Machines and the Like. Beckett and Anderson, 71 Lanark Street, Glasgow, Scotland, 6627 of 1913.

Improvement in the Construction of Shafts for Coal Mines and the Like. T. E. Harris, 20 Peugam Street, Peugam, South Wales, 24,764 of 1912.

An Improved Apparatus for Testing Gas with Miners' Safety Lamps. W. Baxter, Priory Road, Bolton-upon-Dearne, near Rotherham, 27,264 of 1912.

CONSTRUCTION NEWS

Kittanning, Penn.—A small corporation to be known as the Mohawk Mining Co. has taken over the coal under the Miller farm in East Franklin township and will mine the same.

Kittanning, Penn.—Work is now under way extending the line of the West Penn interests to the mines of the Providence Coal & Coke Co. at Kelly Station for the purpose of electrifying the entire plant.

Marion, Ill.—The Scranton and Big Muddy Coal and Mining Co. has just installed a Sullivan compound straight line compressor, size 24x26x16½x30 in. This machine has been erected to operate 22 mining machines.

Shadyside, Ohio—The Webb mine of the George M. Jones Coal Co. is being put into shape for producing a large amount of coal as rapidly as possible. Entries are being driven and the coal is now being produced at the rate of from 40 to 50 cars each week.

Somerset, Penn.—Mines have been opened at six different points near Central City within the recent past, the largest being those of the Berwind-White and Loyalhanna Coal Co. The railroad tracks will be extended to the new operations inside of a few weeks.

Mt. Carmel, Penn.—Residents of Girardville and Ashland are much pleased over the prospects for the new breaker which will be erected by the Lehigh Valley Coal Co. at Packer No. 5 Colliery, which is located about a mile east of Girardville at Rappahannock.

Cleveland, Ohio—An order has been placed with the Great Lakes Engineering Co. for a 10,000-ton steel freighter to take the place of the ill-fated Charles S. Price which was destroyed Nov. 9 in the disastrous lake storm. The boat will be ready for service in the spring.

Kittanning, Penn.—Another coal mine will be added shortly along the lines of the Pittsburgh, Shawmut & Northern Ry. system. James H. Corbetts, contractor, of Kittanning, has secured one thousand acres of coal land at Timblin and the construction of the necessary mine buildings will be begun shortly.

Pottsville, Penn.—A special meeting of the shareholders of the Shamokin Valley & Pottsville R.R. will be held on Dec. 26 to authorize the proposed conveyance to the Susquehanna Coal Co. of the reversionary interests of the company in certain coal lands now leased by the Mineral Railroad & Mining Co.

Martins Ferry, Ohio—The Pursglove-Maher Coal Co. is arranging for another opening to its Black Diamond mine at Neffs. This opening will be in a hollow to the east of the tipple and will take care of the coal under the James Dixon farm. It will not require a new tipple or extension to the railroad tracks, as the mine tramway will be laid from the mouth of the new mine to the present tipple.

Caney, Kan.—It has been announced that work on the proposed Cherryvale, Oklahoma & Texas will begin in January. The road will run through the Oklahoma coal fields and give operators of that section an outlet which has hitherto been obtained under difficulties. About 40 miles of the new road already has been graded between Caney, Kan., and Vinita, Okla. The 61 miles of road to connect those cities will be built at once.

NEW INCORPORATIONS

Cleveland, Ohio—The Short Creek Coal Co. has increased its capital stock from $600,000 to $1,000,000.

Chattanooga, Tenn.—The Four-Mile Coal Co. has been incorporated with a capital stock of $30,000 to develop coal properties.

Hamilton, Ohio—The Murdoch Coal Co. has filed papers with the secretary of state increasing its capital stock from $10,000 to $20,000.

Huntington, W. Va.—The Bengal Coal Co. has been incorporated with a capital stock of $100,000 to develop coal lands near Man, W. Va.

Cleveland, Ohio—The Roby Coal Co., of Cleveland, Ohio has filed papers with the secretary of state increasing its capital stock from $800,000 to $2,000,000.

Uniontown, Penn.—The Cheat Haven Coal & Coke Co. has reorganized under the name of the Fancy Hill Coal Works. Many improvements in the existing plant are contemplated.

Centralia, Ill.—The Wizard Coal Co. has been organized with a capital of $5000 to mine, buy, sell and deal in coal. The incorporators are Frank F. Noleman, F. Kohl, Walter Eis, Harry Kohl, and F. A. Hartman.

Fort Smith, Ark.—The E. D. Bedwell Coal Co. has been organized with a capital of $50,000, all of which has been subscribed. E. Bedwell is president, T. A. Ball, vice-president, and S. H. Abbott secretary-treasurer.

Bellmail Ill.—The Victoria Coal Co. has been incorporated with a capital of $60,000 for the purpose of mining and dealing in coal and other minerals. The incorporators are L. Senior, John Henderson, and G. M. Henderson.

Bluefield, W. Va.—The Sandy Ridge Coal & Coke Co. has been organized at Bluefield with a capital stock of $50,000. The incorporators are E. E. Carter, G. R. Carter, J. H. Carter, and L. Ray, of Bluefield, and W. V. and R. S. Hansel, of McDowell, Va.

Chicago, Ill.—The Midland Counties Coal Co. has been organized in Chicago with a capital stock of $5000 to do a general mining and manufacturing business. The incorporators are Arthur W. Underwood, Nathan S. Smyser and Charles R. Young.

Birmingham, Ala.—The Nunley Ridge Coal Co., with a capital stock of $24,000, has been incorporated with the following officers: R. D. Curry, president and treasurer; H. E. Mc-

Cormack, vice-president and secretary. The offices of the company will be located at Birmingham.

Baltimore, Md.—The Bridgeport Gas Coal Co. has been organized with a capital stock of $60,000 to acquire and deal in coal lands. The principal owners are Aubrey Pearre, Sifford Pearre, Aubrey Pearre, Jr., of Baltimore; John Lowe, of Shinnston, and Gordon Lake, of Independence.

Eugene, W. Va.—The Mingo Washed Coal Co., of Mingo County has been incorporated to mine coal and manufacture gas. The authorized stock is $20,000, and the incorporators are as follows: Harvey Cory, of Pittsburgh, Robert L. Martin, Jr., Maurice A. Songer, of Eugene, J. H. Greene and B. M. Good, of Williamson.

Bluefield, W. Va.—The Appalachian Coal Land Co. has been incorporated with a capital stock of $100,000 ($25,000 seven per cent. cumulative preferred, and $75,000 common) with the following officers: R. S. Ord, president; Bernard McClaugherty, vice-president; W. S. Patterson, secretary and treasurer; J. Elliott Hall, general manager; and T. M. Morrison, chief engineer.

INDUSTRIAL NEWS

Johnstown, Penn.—A Baldwin-Westinghouse locomotive in Lochrie's mine below Scalp Level recently handled 900 tons of coal in one day of 9½ hours.

Evansville, Ind.—Henry F. Allen, of Pittsburgh, representing capitalists of that city who have made arrangements to merge several of the largest coal mines in western Kentucky has leased the building at First and Main Streets for offices.

Connellsville, Penn.—The Baltimore & Ohio R.R. Co. recently began tests on coke breeze for firing engines on the Connellsville division. Officials of the general offices witnessed the tests which are said to have been successful. This fuel is used in the new automatic stoker locomotives.

Barbourville, Ky.—John G. Matthews recently sold his interest in the Ely Jellico Coal Co. to other stockholders in the same concern. This company has during the past ten years paid dividends of over 200 per cent. Mr. Matthews is opening a new mine in the Brush Creek field in Knox County.

Marianna, Penn.—The Farmers' and Miners' Bank following the failure of the Pittsburgh-Buffalo Coal Co. with which it was affiliated has been closed, and its affairs turned over to the bank examiner. It is a state institution with a capital of $50,000, deposits of about $100,000, and a reserve of $5000.

Martins Ferry, Ohio—Mrs. Frances Crymble has sold 50 acres of coal to the Loraine Coal & Dock Co. for $200 per acre, the deal being closed recently. This coal lies close to the Lansing mine of the company and can be easily taken out. This price is several times what is usually paid for coal in Belmont Co.

Philadelphia, Penn.—The Collier "Hampden" built for the Coastwise Transportation Co., of New York, which will be used in carrying coal along the Atlantic coast was successfully launched from the Camden plant of the New York Shipbuilding Co. on Dec. 15. The craft which has a tonnage of 7000 will be completed in about six weeks.

Washington, D. C.—All Illinois members of the House of Representatives recently received telegrams from the head of the labor movement in that state urging an immediate investigation of the Colorado coal strike and the Michigan copper strike. It is rumored also that strong hints of the need for action had also come from the cabinet.

Punxsutawney, Penn.—As the result of a walk-out of miners at the Adrian mine near here, who demanded a closed shop, the Rochester & Pittsburgh Coal & Iron Co. on Dec. 17, closed down the mine indefinitely. Over 500 miners are affected and the coal company's action followed an announcement that the operators would handle trouble independently and not as an association.

Charleston, W. Va.—Shipments of West Virginia coal and coke over the Norfolk & Western Ry. for the month of November amounted to 3,597,002 tons of which 93,036 tons were coke. Pocahontas coal constituted 2,383,308 tons, while all the coke came from this field. The balance of the month's shipment came from the Tug River, Thacker and Kenova fields.

Washington, D. C.—An advance of 10c. per ton or proportional rates on coal from mines in Kentucky and West Virginia to Milwaukee, Manitowac and Kewaunee, Wis., by way of the Pere Marquette R.R. and car ferry was allowed Dec. 19 by the Interstate Commerce Commission. The maintenance of through routes to points on the west shore of Lake Michigan was ordered continued.

Harrisburg, Penn.—The Public Service Commission has received word from the experts who are investigating for the commission the rates of transportation of coal from the Anthracite regions to Philadelphia, that the preparation of their report is sufficiently advanced for them to give assurance that it will be completed and in the hands of the commission not later than February first.

Camden, N. J.—Word was recently received at the headquarters of the Camden Coke Co. in Camden from Trenton, N. J., that Chancellor Walker had refused to modify his order directing the company to abate an alleged smoke nuisance within six months or close its plant at Mt. Vernon and Chestnut Streets. It is believed that this mandatary order of the court will work great hardship upon the plant management.

Morgantown, W. Va.—The North American Coal Co., of West Virginia has closed an agreement with James A. Comley, of Morgantown, for the development of a tract of one hundred acres of coal on the Monongohela River, and along the Buckhannon & Northern R.R. The contract provides for the operation of all three veins of coal, the Pittsburgh vein being most important. The operating company has option for the purchase of the property.

Edmonton, Alberta—The Alberta Coal Branch line of the Grand Trunk Pacific Ry., 37 miles in length, is now complete, affording transportation facilities for the output of the Mountain Park Coal Co. This mine is now producing 500 tons daily, which it is expected will be increased by April next to 2500 tons. The company has erected 50 houses and established a colony of English and Scotch miners. It is proposed to increase the force to 800 men in the near future. The coal is a high-grade bituminous.

Cincinnati, Ohio—Cincinnati coal dealers and steamboat companies are opposed to Senate Bill No. 136 known as the La Follette Seaman's bill as it is believed this measure is detrimental to local river interests. It is understood that the bill provides for the employment of three crews on all river steamboats instead of two as now required, and it is alleged that this would mean that practically every boat on the river would have to be rebuilt, as none of them are now large enough to accommodate more than two crews.

Philadelphia, Penn. — The mild weather thus far this winter has caused anthracite coal operators of Pennsylvania much money expended for the storage of coal. Only a limited amount can be kept on hand at tide-water, and the rest has to be cared for in the anthracite region itself. It has been estimated that as much as 10 per cent. of the total annual production or nearly 7,000,000 tons are in storage at one time. It is neither expedient nor possible to make the operation of the mines dependent upon the state of the weather.

Columbus, Ohio—The mid-winter meeting of the Michigan-Ohio-Indiana Coal Association will be held at Indianapolis Jan. 20-21. Routine matters will be discussed and steps will probably be taken toward fixing a place and time for the 1914 convention. The association is in good condition as to members and finances and B. F. Nigh, secretary has taken up the settlement of claims against railroads for the members and has been highly successful in this work. The amount collected in 1913 is far in advance of that collected during previous years.

Fort Smith, Ark.—J. L. Rhodes electrician was granted a verdict of $1000 and his assistant, D. Hatcher, a verdict of $375 against the Central Coal & Coke Co., of Hartford, by a jury recently. The men sued for $3000 damages each, for injuries which they alleged to have received when they were sent into a mine to make repairs. While they were in the workings the ventilating fan stopped, and their lanterns ignited gas. Since the explosion 200 men employed in the mine refused to return to work because the company has declined to place an extra guard at the fan house to keep the fan in operation at all times.

New Orleans, La.—Owing to the low stage of water on the Warrior and Tombigbee Rivers, the first regular trip of the barge service between this city and the Alabama coal field was not an unqualified success. It has been proven, however, that the barges will be able to navigate the upper rivers with facility, once locks and dams are completed. With the coming of the winter rise several months of deep water are assured. During this time it is expected that a considerable tonnage of coal will be brought to New Orleans by the water route. The power barges will at least have a fair chance to demonstrate what they will be able to do, and upon the result of their performance depends the possible readjustment of market conditions in New Orleans.

COAL TRADE REVIEWS

GENERAL REVIEW

Entire absence of the customary holiday rush for anthracite. Rumors that some coal is even going into storage. Further recession in bituminous.. All markets have lost ground sharply during the week. Some relief anticipated as a result of the restricted production over the holidays.

While ordinarily the holiday period finds an acute shortage of anthracite and a heavy rush of business, the situation this season is completely reversed. The accumulations of coal at the principal distributing centers are so excessive that the companies are welcoming the opportunity for a cessation of operations, while usually the operating departments are being pushed for ever possible ton that can be produced at this time. The individuals are maintaining a full working schedule, but are forcing the market, and as a result substantial concessions on the regular circular are frequently heard of. There are well defined rumors that the companies are stocking 10 per cent. of their production.

A break of 5c. in the Hampton Roads circular on high-grade West Virginia coals, putting these desirable fuels on a basis 5c. off from the regular circular maintained throughout the summer, may be taken as typical of the condition of the soft coal trade at the moment. All markets as a rule are well stocked, and operators are anxiously soliciting new spot business; those who failed to contract in anticipation of a high price level by Jan. 1, are now finding themselves in a difficult position. There are no indications of a rally as yet and conditions are tending more toward a further shading off. But in spite of all the adverse conditions, prices are remarkably well maintained, a fairly profitable price level ruling, with but little sacrificing of demurrage coal in evidence. The anticipated curtailment in production over the holidays is having a steadying effect upon the situation, and will tend to relieve the pressure on the market after the first of the year.

Domestic coal in the Pittsburgh district is reported the dullest in years. The market lost ground decidedly during the week, steam consumption falling off in all lines and prices irregular; some slight improvement in Connellsville coke is the only encouraging feature in the local situation. The market in Ohio is at a complete standstill with dealers loaded up to the full limit of their storage capacity, and mines working under a heavily curtailed schedule. Some contracts are being renewed at last year's figures, and the possibility of labor troubles in April is having a beneficial effect upon the prices at which this business is being done. Dumpings at the West Virginia piers ran good during the week. The Southern market is dull, insofar as new business is concerned, though consumers continue taking regularly on contracts. The usual holiday rush business has failed to develop and coal is accumulating in the local railroad yards for the first time this year.

The Middlewestern market is regarded as the worst for this period in years. Cars are plentiful, and railroads have accumulated surplus stocks and are beginning to cut down orders. As in the East, however, prices are being held better than conditions seem to warrant, the principal cutting being confined to coal on demurrage. The Western markets are exceedingly easy in spite of the Colorado labor trouble.

EASTERN MARKET

BOSTON, MASS.

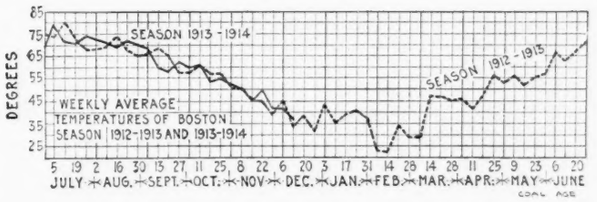
Bituminous quiet and softer. Inquiry for spot coal has ceased and contract demand reduced. Georges Creek remains firm and Pennsylvanias are quiet for tidewater shipment through fairly active all-rail.

Bituminous—There is no material change in the market. The well stocked condition of New England consumers has made the demand for shipment on contracts light and the shippers of New River and Pocahontas are anxious to the extent of actively soliciting spot business. The accumulation of coal at Hampton Roads loading piers has been substantially enlarged and the circular price of $2.85 f.o.b. has been shaded, New River coal having been openly quoted in this market at $2.80. Many are inclined to believe that January will be a particularly dull month for soft coal.

The situation on Georges Creek remains unchanged. This coal continues in good supply, but with the price firm. Pennsylvania coals for tidewater shipment are in little demand due the excessive supply of the Southern grades. The situation at Hampton Roads does not so materially affect all-rail shipment of the Pennsylvania coals. The market is now quotable as follows:

	Clearfields	Cambrias Somersets	Georges Creek	Pocahonta New River
Mines*	$1.00@1.55	$1.25@1.60	$1.67@1.77	
Philadelphia*	2.25@2.75	2.50@2.85	2.92@3.02	
New York*	2.55@3.05	2.80@3.15	3.22@3.32	
Baltimore*			2.80@2.90	
Hampton Roads*				$2.80@2.90
Boston†				3.72@3.82
Providence†				3.72@3.87

*F.o.b. †On cars.



Anthracite—The continuance of warm weather has made this market most inactive. Stove coal appears to be in as poor supply as ever.

The marine freight market remains without change, charters for New England being limited. This ruling rates from Hampton Roads to Boston are 70@75c.

NEW YORK

Under the influence of continued adverse weather and industrial conditions, market remains dull and heavy. Bituminous prices holding remarkably firm. Anthracite dealers overstocked. General curtailment over the holidays.

Anthracite—Mild weather conditions this past week has caused quite a slump in anthracite sales, although comparing the temperature between 1912 and this year there is little variance. Dealers are overstocked and in many instances, if possible, avoid purchasing coal until the new year. Egg coal was held by numerous individuals at 50c. to 60c. off circular and some found it difficult to move even where an equal quantity of stove coal accompanied the egg. Straight stove brought small premiums of 10 to 20 cents. Nut coal in some instances, particularly in the Lehigh grades, sold at 10c. off circular; this size being popular with the peddlers in the free burning grades moved promptly. Pea size continued in fair demand, although buckwheat was plentiful and hard to move even at cut prices. Schuylkill rice is strong, but barley remained inactive. The same condition applied to the Wyoming grades of steam sizes.

From an authentic source it is learned that at the present time the large companies are stocking 10% of their production, which naturally indicates a lack of sufficient orders on hand. The new demurrage rules at all the tidewater points prohibit the holding of coal for an indefinite period and for that reason the companies will have to resort to stocking coal on the ground, which is an expensive proposition, particularly on the prepared sizes due to the breakage in handling. The Reading Co. collieries will be shut down three days a week during the holiday season, and no doubt the same conditions will apply to the Wyoming region. This will materially help conditions all around by Jan. 1.

We quote the New York market on the following basis:

	Upper Ports		Lower Ports	
	Circular	Individual	Circular	Individual
Broken	$5.00	.....	$5.05	
Egg	5.25	$5.25@5.35	5.30	$4.75@5.20
Stove	5.25	5.25@5.40	5.30	5.20@5.35
Chestnut	5.50	5.40@5.50	5.55	5.35@5.45
Pea	3.50	3.40@3.50	3.50	3.35@3.45
Buckwheat	2.75	2.70@2.75	2.45@2.70	2.25@2.70
Rice	2.25	2.25	1.95@2.20	1.80@2.20
Barley	1.75	1.60@1.75	1.70	1.40@1.70

Bituminous trade still remains dull and the tendency toward curtailment by the manufacturers throughout the East, with the exception of some few lines, does not portend much better conditions for the immediate future. The shipments of soft coal have been unusually heavy throughout the season, the contractors taking their supplies freely and the movement on the regular contract tonnage continues in fair volume. Those of the operators who thought it better to keep their tonnage free have found that instead of the high market they expected by Christmas time, an entirely contrary condition obtains.

The decided slump of the market in the West has caused a number of West Virginia operators to look to the East for their market, and this has overtaxed the absorptive power of the market. There is considerable accumulation of coal at tide, a general embargo having been placed on the Pennsylvania R.R. Co., at South Amboy, on Saturday last. The remarkable feature, however, is the fact that in spite of the heavy tonnage available, prices are comparatively well maintained. There appears to be little real sacrifice in the movement of demurrage coal such as one might naturally expect under the conditions. The market is quotable as follows:

West Virginia steam, $2.60@2.75; fair grades of Pennsylvania, $2.70@2.80; good grades of Pennsylvania, $2.80@2.90; best Miller Pennsylvania, $3.10@3.20; George's Creek, $3.15@3.25.

PHILADELPHIA

Hard coalers forced to curtail production. A customary season of short supplies and heavy demand finds large surpluses available, and market dull. Individuals cutting the circular freely. Tidewater points crowded with coal.

It is now either a case of restricted mining, or large demurrage bills on account of coal held in cars without disposition, and the companies, recognizing this fact have resorted to a restriction of mining. This is most unusual at this period of the year, when as a rule, the holiday season is looked on with apprehension, because of decreased shipments, but it looks now as though the closing of the year will find the market in the throes of a general slump. This is due to the weather, which has been anything but propitious. Outside of stove coal there does not seem to be any active market at all, and with all grades piling up on their hands, and no outlet in sight, the companies have anticipated the season's restricted output by a general curtailed mining.

Individual operators, who continue to run their mines, are forcing a market for their output by quoting prices that must sell the coal. Fifty cents off circular for egg is about the lowest quotation to date, with more to come if further holding of the coal involves demurrage. It is understood that tidewater points are crowded with coal, and while this branch of the business has held its own for the last six months, there are indications that too much cannot be expected of it, and if conditions do not improve in the New England market, there is likely to be considerable demurrage paid before the coal is disposed of. Outside of broken and stove, it is simply a hand to mouth market.

The bituminous trade still shows no tendency toward improvement. Offers for spot coal are eagerly taken by the operators, if there is anything that looks like a profit over the cost of production, and this applies to even the best grades. As low as $1.25 has been quoted for the best Pennsylvania coals, and it is freely predicted that even lower prices than this are likely to prevail, if conditions do not change very shortly.

BALTIMORE, MD.

Both the bituminous and anthracite trade dull and uninteresting. Prices are too near actual production cost for comfort. Coke in poor demand.

The past week has been a most uneventful one for the trade. There has been no indication of a rally; in some cases there has been a still further shading off. In Pennsylvania, a 90c. to $1 figure, even for low-grade coals hits the mining interests hard. The same is true of West Virginia, where gas fuels sold variously during the past week from 75c. to 80c., with steam coals about ten cents better. Fine-grade Pennsylvania steam coals were offered by some producing interests around $1.20 to $1.25. The coke market is off in sympathy with the soft-coal trade. West Virginia cokes were offering as low as $1.75, with Pennsylvanias doing about 15 to 20c. better. The market is the worst for many months.

Mining interests are only operating in part through Maryland, West Virginia and western Pennsylvania. The Christmas and New Year's holidays will prevent an over-production even at the shortened time basis. The movement of anthracite to this city is said to be not two-thirds of what it was at this time last year. Unless some real winter weather arrives soon, the situation will be serious. Movement over the piers continues fair for foreign account, but there is little doing now on the domestic coastwise shipping line.

CENTRAL STATES

PITTSBURGH, PENN.

Combination of adverse conditions has caused a relapse from improved conditions noted last week. Mine operations much restricted and prices fluctuating. Prompt coke limited and market showing a slight improvement.

Bituminous—The coal market has lost ground decidedly since last report, when there had been a temporary improvement due to a cold snap, but which only proved to be of short duration. From all viewpoints the condition is unsatisfactory. Manufacturing demand grows lighter as the iron and steel industry slows down, railroad consumption falls off as the freight movement decreases, and domestic demand is poorer than it has been in any season for years. Prices are quite irregular, cutting being the rule when it is necessary to move tonnage. Sales to consumers are frequent at 10c. differential, which normally applies to dealers, making mine-run $1.20 instead of $1.30, and it is possible that in exceptional cases there has been even more cutting. Mine operations are down to about 50%, against 60% in the early part of the month. We quote regular circular prices, subject to shading, as follows: Slack, 90c.; nut and slack, $1.05; nut, $1.25; mine-run, $1.30; ¾-in., $1.40; 1¼-in. steam, $1.50; 1¼-in. domestic, $1.55, per ton at mine, Pittsburgh district.

Connellsville Coke—The market is taking on a much stronger aspect. The amount of furnace coke available at less than the $2 price asked all along by the majority of producers is proving to be quite limited and some buyers do not find desirable brands in the list. While a few transactions have been closed for next year at less than $2, the latest transaction is 12,000 tons for January, at $2. This deal reflects the attitude of many prospective consumers, who purpose buying for January alone instead of for the quarter or half year. They do not think the market will in any event advance above $2, and by purchasing for January only, the month most likely to show difficulties in coke movement, through weather conditions and the celebration of the various Greek and Russian holidays among the men, they will still have the opportunity of profiting by possible declines later. Negotiations are active with many consumers and the next few days are likely to see many contracts closed, a few for the half year, but the majority probably for January only. Prompt coke is in limited supply and is quotable at a relatively low figure only because prompt demand is almost entirely absent. We quote: Prompt furnace, $1.75; contract furnace, $1.90@2; prompt foundry, $2.50@2.75; contract foundry, $2.50@2.75, per ton at oven.

The "Courier" reports production in the Connellsville and lower Connellsville region in the week ending Dec. 13, at 307,790 tons, a decrease of 14,137 tons, and shipments at $305,845 tons, a decrease of 15,786 tons.

BUFFALO, N. Y.

Weather still adverse to any activity in the coal market. Anthracite as dull as bituminous. Mines in Allegheny Valley reducing output. Not so much soft coal on track. No improvement in sight.

Bituminous—The trade is still quiet, with shippers making a little more effort to keep the tracks clear of unsold coal. While there is still coal here and there under demurrage, it is somewhat less and if the local jobbers can control the movement the production will not be large enough to crowd the consumers for storage and reduce prices. It is not believed there will be any improvement in the trade till well into January and not then if the weather continues mild. Buffalo has the advantage in not being a terminal point, for if there is too much accumulation, the seller has a way of sending some of it further on.

While this does not ease the market to any great extent, it is quite an excusable practice where the mine is inclined to load up a single distributing center too much. Another abuse of late is to sell a lot of coal and then ship half as much more and depend on the buyer's good nature to accept the surplus. There is all of the former difficulties with the miners, who are demanding closed shop and many other conditions. But they find the operators independent as a rule, for producers feel that concessions would be fatal, in view of the spring agreements. Quotations are difficult to make, as many prices are paid and only a few getting former figures, which are $2.80 for Pittsburgh lump, $2.70 for three-quarter, $2.55 for mine-run and $2.15 for slack, with slack rather firmer than three-quarter. Allegheny Valley is about 25c. lower than Pittsburgh.

Coke—The coke market continues quiet, with prospects of remaining at the present low figure till there is a genuine

stir in the iron trade. Prices remain on the basis of $4.60 for 72-hr. Connellsville foundry.

Anthracite—So far as actual demand is concerned, the anthracite market is fully as flat as anything else. The local consumption has seldom been as light at this time of the year. Retail dealers are making a bare living and now that the Lakes are closed—without a sign of ice—the rail line demand is not sufficient to take care of the most ordinary output, and Buffalo shipping agents are already beginning to take Lake tonnage for loading to hold on winter storage. The Lake trade closes with the shipment of 103,100 tons in December, a large amount, and 5,033,296 tons for the season, as against 3,925,083 tons in 1912.

TORONTO, CAN.

Trade duller than at any time in more than a decade.

Trade conditions show little change, sales being slow on account of the continuance of unseasonably mild weather. Dealers state that business since the beginning of November has not been so dull at this season since 1902, when similar conditions prevailed. Quotations at retail are as follows: Egg, stove and nut, $8.25; pea, $6.75; soft coal, steam, steam screenings, $4.35; domestic lump, $6; cannel coal, $7.50. Wholesale, ¾ lump, f.o.b. cars, $3.85; soft coal, screenings, f.o.b. cars, $3.

COLUMBUS, OHIO

Trade is weak in every department, due to continued unfavorable weather. Demand light in all grades and mines are being operated at about 50 per cent. capacity. Prices have weakened under the influence of unfavorable weather and the trade is not promising.

Dealers' stocks of domestic grades are large and they are unable to take care of any more coal until they can move their surplus. Customers are slow in placing orders now, believing that there may be lower prices later on. Most of the larger users have laid in their winter's supply and the trade is at a standstill. The smaller dealers are not inclined to take chances on the payment of demurrage. There is some demand for the fancy grades, such as Pocahontas and rescreened varieties.

But domestic trade is not the only branch which shows a softness. The steam business is light and many iron and steel concerns have closed down. All this affects steam grades adversely and the volume of business is comparatively small. In this connection reports of fuel used by railroads are smaller as the freight movement is decreasing. What steam contracts are expiring at this time are being renewed at the same figures that prevailed last year.

The Lake season is now over, and reports from the Hocking Valley Docks at Toledo shows that 2,747,000 tons were loaded during the season, which is an increase of more than 325,000 tons over the previous year. Production has been largely curtailed by the lack of orders and as a result mines have not been operated to their full capacity. In the Hocking Valley and Pomeroy Bend districts, the output is estimated at 45 to 50 per cent. of normal and the reports from the strictly domestic fields show a still smaller percentage. In eastern Ohio the output has been about 40 per cent. of the average.

Quotations in the Ohio fields are as follows:

	Hocking	Pittsburgh	Pomeroy	Kanawha
Domestic lump	$1.85 @ 1.75	.....	$2.00 @ 1.85	$1.70 @ 1.60
3-4 inch	1.65 @ 1.60	$1.20 @ 1.15	1.80 @ 1.70	1.50 @ 1.45
Nut	1.30 @ 1.20	.....	1.65 @ 1.55	1.30 @ 1.25
Mine-run	1.35 @ 1.30	1.10 @ 1.05	1.30 @ 1.25	1.35 @ 1.25
Nut, pea and slack	0.80 @ 0.75	.....	0.90 @ 0.85	0.80 @ 0.75
Coarse slack	0.79 @ 0.65	0.90 @ 0.80	0.80 @ 0.75	0.70 @ 0.65

DETROIT, MICH.

Plenty of coal and all orders promptly filled. No serious condition anticipated here during the balance of the season. Good stocks on hand.

Bituminous—The recent cold snap has developed a greatly increased demand, but supplies were good, and orders as a rule have been promptly filled. A congestion at junction points south of here, was materially relieved during the previous mild weather and the general opinion is that no serious trouble will be experienced in this direction during the balance of the winter. A falling off in the freight movement and curtailment in the general manufacturing demand have reduced the steam business materially. Contracts expiring Jan. 1, will, as a rule, be renewed on the same basis as last year. Domestic dealers have ample stocks on hand to meet almost any demand that might appear, and new orders are not plentiful. A change in the weather condition will be necessary before an active business can be expected. Prices are not materially changed, but are probably somewhat firmer. The market is now quotable as follows:

	W. Va. Splint	Gas	Hocking	Cambridge	No. 8 Ohio	Pocahontas	Jackson Hill
Domestic lump	$1.50	....	$1.50	....	....	$2.25	$2.50
Egg	1.50	....	1.50	....	....	2.25	2.50
Nut	1.35	....	1.20	....	....	....	....
Steam lump	1.25	....	....	....	....	....	....
¾-in. lump	1.10	$1.10	1.10	$1.10	$1.10	....	....
Mine-run	1.00	1.00	1.00	1.10	1.10	1.40	....
Slack	0.90	0.90	0.65	0.90	0.90	....	....

Anthracite—All the anthracite sizes are coming in freely and stove coal, which was decidedly short, is now in easy supply at the circular price. Indications point to a surplus of anthracite coal at the present time.

Coke—The coke market is firmer than at any time for a long period. Connellsville foundry is quoted at $1.75, Semet Solvay at $2.75, and gas house at $2.70 f.o.b. ovens. A number of the local ovens are curtailing their production.

HAMPTON ROADS, VA.

Heavy loadings for the government during the week. About normal supply of coal at tidewater. Prices practically the same as for several weeks.

Dumpings for the week have been good, the government alone taking nearly 35,000 tons. Coastwise and foreign shipments have also been fairly heavy. Prices quoted are practically the same as they have been for some time, and although some large sales have been made it is impossible to ascertain at what prices.

Coal moving during the week has nearly all been Pocahontas and New River, there being little demand for the other grades just at this time. Owing to the demand for high volatile being light, few shipments have been sent to tidewater and in consequence there is little of this coal on hand.

During the past week the N. & W. Ry., at Lamberts Point, gave their new pier a test and found everything working satisfactorily. There still remains considerable work to be done on the pier and the prospects are that it will be about the middle of January before any coal is dumped over it.

LOUISVILLE, KY.

Consumption incredibly small for the season of the year. Car shortage relieving the situation somewhat. Curtailed production over the holidays also helping out.

With every prospect for an unusually mild Christmas, the coal trade in this section is facing an unusual state of affairs. The consumption of coal has been incredibly small, and the demand has been of the same sort. The domestic grades are practically not moving at all, many operators and wholesalers, in fact, having received numerous cancellations. Coal stored during the latter part of the summer and early in the fall, for the demand which normally exists at this time, is still on hand, and there is no room for additional storage.

A car shortage is about all that saves the situation from utter demoralization; it keeps the amount of coal on the tracks from reaching the proportions which it otherwise would. The holiday lay-off at the mines will also help things considerably, and if the long-expected winter arrives by Jan. 1, or shortly thereafter, business should show a marked improvement. Until then, it is emphatically a market governed by unseasonable weather. The situation of the steam market is strikingly different from that in the domestic market. The greatly reduced production of the prepared grades has resulted in a similar reduction in the quantities of screenings available, and as most industries are operating on full time, this means something resembling a shortage on the local market.

The better grades of eastern Kentucky, such as Straight Creek, are selling at 90c. a ton, f.o.b. mines, and prospects are for still better prices soon. Western Kentucky nut and slack is worth 65 and 70c., and is in good demand. Prices for domestic sizes are not being freely quoted at much below last week's low level, operators fearing to demoralize the market, but the best grades can be had for $1.85 or thereabouts.

SOUTHERN AND MIDDLEWESTERN

BIRMINGHAM, ALA.

No improvement in coal market. Stocks accumulating in railroad yards. Blacksmith coal normal. Little activity in furnace or foundry coke. The car situation has improved.

There is no change in the coal market, either on steam on domestic coal, unless it be for the worse. The trade is now practically dead, as far as inquiries or new orders are concerned; contract tonnage is moving regularly, however, though in some instances the consumers are taking only the minimum called for. One of the large interests is offering the

best Cahaba coal at $2.75 per ton, which is 50c. under the market for this season, and even then they are not moving their tonnage.

For the first time in several years, a stock of coal is accumulating in the railroad yards, which has a tendency to weaken the market. While prices on domestic coal have been reduced in the effort to obtain business for prompt shipment, prices on the steam grades seem to be holding up, though the steam market is in the same condition as the lump trade. As the market during the summer months, which is usually the dull period, was excellent, the operators are at a loss to understand the slump at this season, which is naturally the best of the year. Blacksmith coal seems to be holding up better than any of the other grades. Little activity is shown either on furnace or foundry coke, but the prices are holding up. On account of the quiet coal market, which necessarily means small shipments, the car situation shows an improvement, which is really the only satisfactory condition at the present time. The usual holiday rush shipments have, so far, failed to materialize.

NEW ORLEANS

Sales show unusually low total. Lack of demand for bunker supply. Prospects good for business after the turn of the year. Cargo outlook poor owing to low rates being named for Atlantic coast product.

The domestic market was quiet due to the return of spring weather. There were plenty of ships in port but they had either coaled last week or were waiting until next week. Total sales in the harbor were the lightest of the winter and points in the interior took little coal, due largely to the fact that taxes are assessed on supplies on hand Jan. 1.

Next week promises to be little better than the one just closed, but there are prospects of considerable business after New Year's. Stocks are believed to be limited and general replenishing will begin at once. Prospects for increased exports, so far as parcel shipments are concerned, are good. The cargo business is expected to continue quiet in the face of the low rates that are being made on coal from the Atlantic seaboard.

INDIANAPOLIS

Mild weather still prevails, cutting down consumption to a minimum. Prices are being held by closing down the mines, though some track coal has moved at bargain rates. Everybody waiting for real winter weather.

Mild weather continues and the coal trade is as small for December as it ever has been within memory of local coal men. Generally speaking, prices remain unchanged, but would be lower, if there was advantage in making them so. There is cutting of prices but this is usually on track coal, to save demurrage charges. For example, with domestic lump listed at $1.90, it is found that sales have been made even down to $1.55. There is no incentive to reduce mine prices in the present kind of weather, for the price is not the controlling factor.

The general opinion has been that the yards are necessarily filled, because of the mild weather, which made consumptive needs small but this has been disproved by a good authority. There have been two or three spells of sharp weather that looked like the real beginning of winter, and although it lasted only two or three days there was almost day and night hauling, during this time. Then came the teamsters' strike, and the retail yards of the state were never busier, probably, than for these few days.

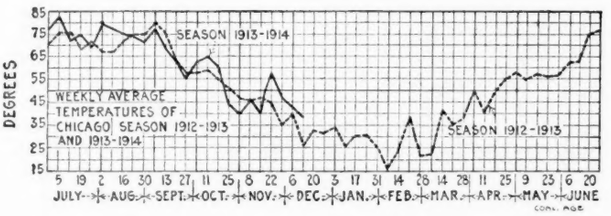
So, after all, considerable holes were made in retailers' piles. It also seems the car shortage, at the time Indiana coal begins to move, hindred the piling up of large stocks. Everybody in the coal business is waiting for winter weather. Operators that ship outside the state say the commercial department of the trade is not up to normal, but in Indiana it is hard to find the factory that is down or running below normal schedule for this time of year. The block coal field is suffering less than the others.

CHICAGO

Mild weather has resulted in a sharp decline in production. Demand for anthracite light and a comparatively small amount of smokeless coal is being moved. Nominal prices are quoted for Springfield coal. The coke market dull.

Coal-carrying roads entering Chicago announce that the continuation of mild weather has resulted in a marked decline in their tonnage. W. J. Jackson, receiver and general manager of the Chicago & Eastern Illinois says his company could handle 35% more coal than is now being offered for shipment. A sharp cut in shipments also has been reported by the Illinois Central and Big Four roads.

The coal market in Chicago, generally, is dull. Anthracite coal is in exceedingly light demand. Shipments direct from the mines have been curtailed and in some instances price reductions ranging between 25c. and 40c. a ton have been made. A marked reduction in the movement of smokeless coal has also been noted. Standard shippers have been able to obtain a price of $1.40 on a few cars of mine-run, but a majority of sales have been based on $1.25. The demand for Hocking coal is light and production is being reduced. Only nominal prices are being quoted for Springfield coal. Comparatively little domestic lump is being made and steam coal is not being sold in large volume.



There is little demand for furnace and domestic coke. Ordinary screenings command from 55c. to 65c. a ton, while some of the higher grades are being sold at from 70c. to 80c. Prices for Indiana coal are variable. A few concerns have continued to produce domestic lump coal in order to get screenings for their steam contracts and a good deal of this coal is up to demurrage in the Chicago market. It is being sold at prices varying between $1.25 and $1.60. Many of the producers have kept their coal away from Chicago and sold it where conditions are more favorable. Carterville operators are declining to accept prices offered on the open market in Chicago for spot coal and unless sales are made for shipments direct from the mines it is the practice of these producers to close down their mines. Prices for lump and egg range between $1.50 and $1.75.

Prevailing prices at Chicago are:

	Springfield	Franklin Co.	Clinton	W. Va.
Domestic lump	$2.32	$2.45@3.05	$2.27	
Steam lump	1.97		1.97	
Egg		2.45@3.05		$4.05@4.30
Mine-run	1.87	2.30	1.87	3.30@3.45
Screenings	1.42	1.75@1.85	1.27	

Harrisburg—Domestic lump and egg, $2.55@2.65; steam lump, $2.25; mine-run, $2.25; screenings, $1.65@1.75; No. 1 nut, $2.55@2.65; No. 2 nut, $2.55.

Carterville—Lump, egg and No. 1 washed, $2.55@2.65; No. 2 washed, $2.55.

Coke—Connellsville, $5.25@5.50; Wise County, $5@5.25; byproduct, egg, stove and nut, $4.90@5; gas house, $4.75@4.85.

ST. LOUIS, MO.

Car supply plentful and market overshipped. Current business worst for this period in years. Railroads well stocked.

Continued mild weather and no demand is the feature of the local market. The market on screenings has been exceptionally good. Carterville has gone up to around 60c. and Standard as high as 50c. However, the market fluctuates daily, depending upon the demand and supply. It is a heartbreaking job right now to sell any amount of lump coal, and that which is being placed is scattered in one and two carlots over a wide territory.

The dealer demand is practically nothing; all the yards are loaded, and steam trade is letting up for the holidays. There is absolutely no anthracite market. Coke is going begging, and so is smokeless.

The railroads have been stocking up quite heavily, and some of them feel that by the end of this month they will have a sufficient tonnage on hand for storage purposes, aside from their contracts. The Rock Island has been taking about 1500 to 1800 tons a day over their contracts, and are about ready to quit. Various other roads are figuring along the same lines. For the first time in many months cars are more than plentiful on all roads.

The prevailing market is:

	Carterville and Franklin Co.	Big Muddy	Mt. Olive	Standard
2-in. lump	.....	.....	.....	$1.00*
3-in. lump	.....	.....	$1.40*	.....
6-in. lump	$1.30 @ 1.50	$2.25	1.50*	1.20*
Lump and egg	1.85 @ 2.15	.....	.....	.....
No. 1 nut	1.40 @ 1.60	.....	.....	.....
Screenings	0.40 @ 0.50	.....	.....	.....
Mine-run	1.10 @ 1.20	.....	.....	.....
No. 1 washed nut	1.75	2.25	1.40	.....
No. 2 washed nut	1.35	.....	1.60	.....
No. 3 washed nut	1.15	.....	.....	.....
No. 4 washed nut	1.05	.....	.....	.....
No. 5 washed nut	0.50	.....	.....	.....

*Asking price.

KANSAS CITY, MO.

Colder weather materially stimulated the market. Mines tuning up to greater capacity and outlook much improved.

A cold wave over Kansas and Missouri has materially improved the situation and operators are now optimistic over the outlook. Though the movement of coal has been accelerated, no change in prices is expected before the opening of the new year. At that time, a substantial advance will go into effect, provided, of course, that the cold wave proves of some duration. Demand responded quickly to the weather and dealers' stocks are rapidly being depleted. Mines have in many instances already increased their working time. The majority were only on about half time prior to the change in the weather. Domestic coal is moving better than for several months, while steam lines are even brisker than unsual. Kansas deep shaft fancy lump is quoted at $2.50, f.o.b. mines; Arkansas anthracite, $4.35; Missouri block $2.25.

OGDEN, UTAH

Western markets easy in spite of the acute labor situation. Temperatures mild and cars in plentiful supply. Labor trouble in Colorado not liable to affect the Wyoming markets.

Cold weather is still confined to Denver, Cheyenne and immediate territory, with warm days and temperate nights in eastern Nebraska, Utah, Idaho, Washington and Nevada. Most of the operators in Wyoming and Utah are short of lump orders and are carrying a surplus of nut coal on track at the mines. Coal dealers throughout the territory are buying in limited amounts and nothing but a good storm can improve the present market conditions.

During the past week the mines at Rock Springs, Wyo., were bothered with a car shortage, and two days were lost. This condition reduced the amount of slack and steam coal and for a short period there was a "flurry" in the steam market, as the sugar factories are still consuming large quantities of this grade of coal. During November the Rock Springs district sent quite a large tonnage to Denver, but conditions have changed so that it is hardly probable Denver will need the assistance of Wyoming mines in order to be supplied with coal. The severe snow storm of two weeks ago injured, rather than helped, the coal situation. Hardly a commercial order was delivered in Denver from Dec. 1 to 13. This caused a conjestion and Denver is now flooded with coal. It is estimated there is sufficient coal to last thirty days.

While the market in Utah and Idaho shows a very slight improvement, the conditions east of Wyoming are becoming more discouraging. It is reported the mines in northern Wyoming are only working two and three days per week on account of the weak condition of the Nebraska market.

The mines in the strike zone are working 45 to 55% capacity with a large portion of the coal being consigned to Denver as the market in Kansas is weak. California shows a slight improvement due to rains and while the market is weak, a few shipments are being made to this district.

Owing to weak condition of the market in Nebraska, quotations have eased off and are now:

	California	Colo. & Neb.	General
Lump	$3.00@3.50	$3.00	$2.75
Nut	2.50@3.00	2.00	2.25
Mine-run	1.85	1.85	1.85
Slack	1.00	1.00	1.00

PRODUCTION AND TRANSPORTATION STATISTICS

VIRGINIAN RAILWAY

The total shipments of coal over this road for October of the current year were 476,482 tons as compared with 338,518 tons for the same month last year. For the ten months to Oct. 31 of the current year, the shipments were 3,768,423 tons as compared with 2,860,739 tons for the same period last year.

SOUTHWESTERN TONNAGE

The following is a comparative statement of the Southwestern tonnage for August and the first eight months of the years 1912 and 1913:

State	August		Eight Months	
	1912	1913	1912	1913
Missouri	123,603	178,949	1,879,873	1,799,206
Kansas	408,947	451,968	3,203,861	3,586,093
Arkansas	172,090	178,904	1,205,149	1,205,005
Oklahoma	232,768	289,949	1,814,957	2,225,922
Totals	1,027,408	1,099,770	8,103,840	8,816,226

FOREIGN MARKETS

GREAT BRITAIN

Dec. 12—It is still difficult to obtain supplies owing to the full state of colliery order books for December and early January. Quotations are approximately:

Best Welsh steam	$5.04@5.16	Best Monmouthshires	$4.44@4.50
Best seconds	4.86@4.98	Seconds	4.08@4.20
Seconds	4.68@4.80	Best Cardiff smalls	2.64@2.76
Best dry coals	4.56@4.80	Seconds	2.52@2.64

The prices for Cardiff coal are f.o.b. Cardiff, Penarth or Barry, while those for Monmouthshire descriptions are f.o.b. Newport; both net, exclusive of wharfage, and for cash in 30 days.

British Exports—The following is a comparative statement of British exports for November and the first 11 months of the last three years, in long tons:

	November		11 Months		
	1912	1913	1911	1912	1913
Anthracite	268,098	255,959	2,233,164	2,316,909	2,726,983
Steam	4,529,410	4,322,462	42,863,716	42,429,063	49,030,578
Gas	958,261	936,829	9,594,122	9,730,410	10,547,038
Household	156,401	140,129	1,374,219	1,497,808	1,635,335
Other sorts	285,275	258,025	2,740,134	2,873,446	3,230,821
Total	6,197,445	5,913,404	58,805,355	58,747,636	67,170,665
Coke	125,601	126,307	847,883	928 612	1,115,317
Manufactured fuel	142,025	163,087	1,481,829	1,394,032	1,874,952
Grand total	6,465,071	6,202,798	61,236,067	61,070,280	70,160,934
Bunker coal	1,714,064	1,755,090	.....	16,734.586	19,189,501

COAL SECURITIES

The following table gives the range of various active coal securities and dividends announced during the week ending Dec. 20:

Stocks	Week's Range High	Low	Last	Year's Range High	Low
American Coal Products	..	..	80	87	80
American Coal Products Pref.	..	..	105	109½	102
Colorado Fuel & Iron	27¾	26	27¾	41½	24½
Colorado Fuel & Iron Pref.	....	....	155	155	150
Consolidation Coal of Maryland	....	....	102½	102½	102½
Lehigh Valley Coal Sales	190.	175	175	....	....
Island Creek Coal Com	48	46	47	53½	47
Island Creek Coal Pref.	83½	83¼	83½	85	80
Pittsburgh Coal	18⅝	18	18⅛	24⅜	14½
Pittsburgh Coal Pref.	86½	85	86½	95	73
Pond Creek	18½	17	18½	23¾	16½
Reading	165¼	169⅝	164⅞	171	151⅜
Reading 1st Pref.	83⅞	83⅞	83⅞	92½	82½
Reading 2nd Pref.	88	86⅜	86⅞	95	84
Virginia Iron, Coal & Coke	37	36	36	54	36

Bonds	Closing Bid	Asked	Week's Range or Last Sale		Year's Range	
Colo. F. & I. gen. s.f.g. 5s	90	93	91⅛	Dec. '13	90	99½
Colo. F. & I. gen. 6s	102	106½	107¼	June '12	..	..
Col. Ind. 1st & coll. 5s. gu.	75	78	76	Dec. '13	76	85
Cons. Ind. Coal Me. 1st 5s	76	79	76	Aug. '13	76	76
Cons. Coal 1st and ref. 5s	..	92	87	Dec. '13	87	87
Gr. Riv. Coal & C. 1st g 6s	..	..	102⅝	April '06	..	..
K. & H. C. & C. 1st s f g 5s	92½	95	92¼	92¼	91	98
Pocah. Con. Coll. 1st s f 5s	..	85½	86	Oct. '13	85	87⅞
St. L. Rky. Mt. & Pac. 1st 5s	76	77	76	Dec. '13	73	80½
Tenn. Coal gen. 5s	96	97½	96	96	96	103
Birm. Div. 1st consol. 6s	100⅜	101	101	Nov. '13	100⅜	103
Tenn. Div. 1st g 6s	100½	101½	100⅞	Oct. '13	99	102
Cah. C. M. Co. 1st g 6s	..	..	103	July '13	103	103
Utah Fuel 1st g 5s	..	..	..	..	..	..
Victor Fuel 1st s f 5s	..	84	80	May '13	79¾	80
Va. I. Coal & Coke 1st g 5s	92½	93	92½	Dec. '13	92	98

DIVIDENDS

Lykens Valley R.R. & Coal—Dividend of 2% payable Jan. 2, to holders of record Dec. 15.

Mahoning Coal R.R—Dividend on the common stock of $5 payable Feb. 2 to holders of record Jan. 9, and $1.25 on the preferred payable Jan. 1 to holders of record Dec. 20.

Mine Hill and Schuylkill Haven—Dividend of $1.25 payable Jan. 15 to holders of record Dec. 20 to Jan. 14.

Reading Co.—Regular quarterly dividend on the common stock of 2% payable Feb. 12 to holders of record Jan. 26.

Central Coal & Coke Co.—Regular quarterly dividend of 1½% on the common, and 1¼% on the preferred both payable Jan. 15 to holders of record Jan. 1 to Jan. 15.

Island Creek Coal Co.—Regular quarterly dividend on the common of 50c. payable Feb. 2 to holders of record Dec. 23, and regular quarterly on the preferred of $1.50 payable Jan. 1 to holders of record Dec. 23.

FINANCIAL DEPARTMENT

Reading Company

The Reading Co., reports, in part, for the year ended June 30, 1913 as follows:

The combined income account of the Reading Co., the Philadelphia & Reading Railway Co., and the Philadelphia & Reading Coal & Iron Co. compares as follows:

	1913	1912	1911	1910
Gross	$102,822,823	$89,390,135	$88,731,631	$87,768,252
Exports and imports	73,079,811	66,734,124	65,104,651	61,954,341
Net	29,743,012	22,656,011	23,626,980	25,824,911
Fix. chgs.	14,643,138	14,573,797	15,691,274	15,048,842
Surplus	*15,099,874	8,082,214	7,935,604	10,776,069
Reading Co. dividends and sinking fund charges were:				
1st pfd. div.	$1,120,000	$1,120,000	$1,120,000	$1,120,000
2d pfd. div.	1,680,000	1,680,000	1,680,000	1,680,000
Com. stk. div.	4,900,000	4,200,000	4,200,000	4,200,000
Gen. mtg. sk.fd.	502,193	508,513	459,649	433,345
	$8,202,193	$7,508,413	$7,459,649	$6,333,345
Sur. after divs.	$6,897,681	$573,801	$476,055	$4,742,724

*Equivalent, after deduction of $502,193 for the general mortgage sinking fund, to 4% on the $28,000,000 first preferred stock, 4% on the $42,000,000 second preferred stock and 16.9% on the $70,000,000 common stock. This compares with 6.8% in 1910-11 and 10.8% in 1909-10.

	1913	1912	1911	1910
Receipts	$40,983,063	$35,733,652	$34,390,139	$33,217,936
Oper. expenses	37,196,144	34,612,338	32,833,569	31,240,645
Net	3,786,918	1,121,115	1,556,561	1,977,391
New work at col.	.....	.....	1,139,040	1,216,015
Int. debt to Rdg. Co., etc.	2,552,676	864,083	434,238	743,957
Deple lands fd.	.....	.....	.....	445,867
Fixed charges and taxes	94,649	85,445	$6,588	88,818
Surplus	1,139,592	171,577	*103,316	*71,501

* Deficit.

	1913	1912	1911	1910
†Income	$9,624,866	$8,085,061	$8,677,841	$9,122,231
Expenses	104,859	110,886	102,642	107,442
Net	9,520,007	7,974,175	8,575,199	9,013,790
Fixed charges and taxes	5,258,331	5,572,375	4,866,586	4,798,595
Surplus	4,261,676	2,401,800	3,708,613	4,215,195

† Does not include dividend paid by the Philadelphia & Reading Railway Co.

The accumulated surpluses of the three companies June 30, 1913, were as follows:

Reading Company—		
*Surplus year ended June 30, 1913	$10,633,930	
Less dividends paid and sinking fund	8,202,193	
Surplus for year	2,431,737	
Previous surplus June 30, 1912	22,404,725	
Surplus as of June 30, 1913		$24,836,461
Philadelphia & Reading Railway—		
Surplus year ended June 30, 1913	$9,698,607	
Less dividends, etc.	6,904,501	
Surplus for year	$2,794,106	
Previous surplus, June 30, 1912	8,765,980	
Surplus as of June 30, 1913		$11,560,086
Philadelphia & Reading Coal & Iron Co.		
Surplus year ended June 30, 1913	$1,139,592	
Surplus as of June 30, 1912	1,459,694	
Surplus as of June 30, 1913		$2,599,286
Total three companies June 30, 1913		38,995,833

*Include $6,372,255 dividends from P. & R. Ry. Co.

In connection with the surplus of Reading Co., the directors have taken the following action:

On the first preferred stock, a quarterly dividend of 1% was declared, payable Sept. 11, 1913, and the sum of $840,000 was set apart to make provision for further quarterly dividends upon that stock as follows: 1% payable Dec. 11, 1913; 1% payable Mar. 12, 1914; 1% payable June 11, 1914.

As to the second preferred stock, a quarterly dividend of 1% was declared, payable July 10, 1913, and the sum of $1,260,000 was set apart to make provision for the following additional quarterly dividends upon that stock: 1% payable Oct. 9, 1913; 1% payable Jan. 8, 1914; 1% payable Apr. 9, 1914.

On the common stock, a quarterly dividend of 2% was declared, payable Aug. 14, 1913.

The dividends paid during the year were the regular quarterly dividends at the rate of 40% per year on the first and second preferred stocks and two quarterly common dividends of 1½% each, and two of 2% each, making a total of 7%, the common stock having been raised from a 6% to an 8% annual basis during the year.

President George F. Baer says as follows:

The gross receipts of the Coal & Iron Co. increased $5,249,410 during the past fiscal year as compared with the previous fiscal year, and the expenses increased $2,583,606, a net increase of $2,665,803.

The net decrease of the fixed charges and taxes of the three companies for the year ended June 30, 1913, as compared with the year ended June 30 1912, was $11,472.

The tonnage of anthracite coal carried increased from 11,224,945 tons in 1911-1912 to 12,860,092 tons in 1912-1913, a gain of 1,635,147 tons, or 14.57%, and the tonnage of bituminous coal increased from 14,806,222 tons to 16,115,417 tons, a gain of 1,309,194 tons, or 8.84%. The revenue from traffic increased from $19,123,327 to $22,060,057, a gain of $2,936,729, or 15.36%.

The Philadelphia & Reading Coal & Iron Co.

The total production of anthracite coal from the lands owned, leased and controlled by the Philadelphia & Reading Coal & Iron Co. for the year ended June 30, 1913, was 12,807,996 tons, as compared with 10,098,831 tons mined during the previous year, an increase of 2,709,165 tons, or 26.83%. During the year the company mined 11,089,742 tons, an increase of 2,418,729 tons, or 27.89%; purchased 524,574 tons, a decrease of 116,697 tons, or 18.20%, and sold 10,478,603 tons, an increase of 553,912 tons, or 5.43% as compared with the previous year. On May 1 the umpire appointed by the board of conciliation to settle the claim of employees for an additional amount of wages due under the sliding scale percentage, decided in favor of the men. Under this award the company will pay to its employees the sum of $106,486.

The total sum expended for improvements during the year and charged to expenses was $1,241,070 as against $839,742 the previous year. The Philadelphia & Reading collateral sinking fund loan has been reduced by the payment of $30,000, for which this company has been reimbursed by the Reading Co. The increase of receipts from the sale of anthracite over last year was $5,057,056; the increase in receipts from sale of bituminous and other sources was $192,353, making an increase in gross receipts of $5,249,410 as compared with previous year. The increase in expenses, excluding the amount expended for improvements, amounted to $2,182,278. Cost of transportation of coal by rail and water during the year was $10,093,802 as compared with $7,700,695 last year.

READING CO. BALANCE SHEET JUNE 30

Assets	1913	1912	1911	1910
R.R. equipment	$37,459,916	$37,331,087	$34,610,517	$33,783,761
Floating equip.	3,644,509	3,643,757	3,718,899	3,768,817
Equip. acct.	10,344,670	6,243,339	9,861,041	8,015,053
Real estate	16,886,936	17,159,222	17,114,402	17,123,350
P. & R. bds. own.	20,000,000	20,000,000	20,000,000	20,000,000
Bds. sundry cos.	26,414,493	26,960,730	27,465,267	25,540,958
P. & R. stk. own.	42,481,700	42,481,700	42,481,700	20,000,000
P. & R. C. & I. stock owned	8,000,000	8,000,000	8,000,000	8,000,000
Tks. sund. cos.	53,313,452	53,312,451	53,141,700	53,441,441
P. & R. C. & I. Co.	72,980,171	73,466,529	74,423,817	75,385,786
Sund. R. Rs., etc.	4,057,967	3,242,207	2,964,639	2,976,718
Cash	2,716,197	4,606,524	2,496,554	5,260,269
Accrued inc.	372,165	373,291	348,187	355,864
Miscellaneous	384,127	700,471	872,540	891,563
Total	299,055,806	297,525,315	297,498,785	274,253,582
Liabilities:				
Stocks	140,000,000	140,000,000	140,000,000	140,000,000
Bonds	129,312,658	130,216,650	131,266,950	109,001,950
Conting. acct.	1,539,296	1,338,486	1,538,594	1,538,594
Ac. int. and taxes	3,366,543	3,319,172	3,270,055	2,813,090
Philadelphia & R. Ry.	.....	.....	.....	112,174
Cur. business	370,340	41,800	80,178	.692,851
Miscellaneous	845	571	23	899
Profit and loss sur.	24,836,461	22,608,626	21,342,984	20,094,021
Total liab.	299,055,806	297,525,315	297,498,785	274,253,582

TRAFFIC STATISTICS

	1913	1912	1911	1910
Miles operated	1,020	1,015	1,014	1,002
Locomotives	987	989	1,026	1,032
Pass. equipment cars	855	861	852	776
Fgt. equpt. cars	42,651	40,210	41,912	40,971
Service cars	1,000	947	938	911
Float equpt (tugs and barges)	135	127	128	130
Pass carried	27,620,457	26,987,719	28,812,798	31,333,231
Pass. car. 1 mi.	410,785,112	398,657,408	410,710,083	411,109,327
Rate p. pass Im.	1.729c.	1.733c.	1.903c.	1.716c.
Coal (a) car (tns)	12,860,092	11,224,945	11,675,405	10,929,612
Coal (bi) car (tns)	16,115,417	14,806,222	13,848,189	13,241,198
Merchd. carried	26,550,439	22,711,791	22,284,179	23,260,452
*Mer. car 1 mi.	1,994,401	1,713,417	1,647,364	1,220,759

*000 omitted.